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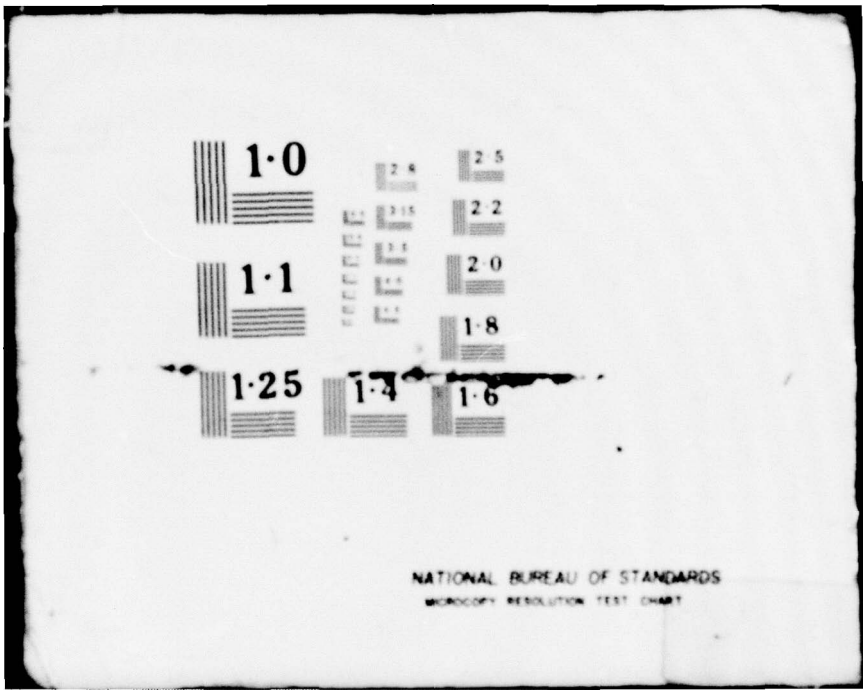
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AN ACQUISITION ALTERNATIVE: SYSTEM MODIFICATION TO SATISFY MISSION NEEDS

Barbara J. Klein, GS-12
Michael A. Smigel, GS-12

LSSR 16-79B

UNITED STATES AIR FORCE
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The process of acquiring major military weapon systems to satisfy defense mission needs has become an increasingly complex and costly undertaking in both time and money. Modification of existing systems to add new capabilities is presently viewed as an alternative process to new weapon system acquisition for Air Force modernization requirements. This thesis reviewed this alternative process as it exists today by addressing three objectives: (1) to develop a current annotated bibliography of studies and guidance regarding Class V modification management; (2) to identify and compare existing models that have been developed to describe the modification management process; and (3) to identify outstanding issues and problems in the area of managing Class V modifications that are considered important by the managers. The first two objectives were accomplished and presented as a result of an extensive literature search. Managers of current modification programs categorized as Class V, defined as major, and involving four USAF weapon systems, were interviewed for reactions to possible problems and comments on existing issues. Interview results were presented and analysed; the researchers offered conclusions based on the findings, and suggestions for further research.

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AN ACQUISITION ALTERNATIVE:

SYSTEM MODIFICATION TO SATISFY MISSION NEEDS

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

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Jack L McChesney
COMMITTEE CHAIRMAN

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CHAPTER I

INTRODUCTION

Statement of the Problem

The process of acquiring major military weapon systems[1] to satisfy defense mission needs has become an increasingly complex and costly undertaking in both time and money. This process often spans many years from the initial need identification until the appropriate weapon system response is delivered and operational. Modification of existing systems to add new capabilities is presently viewed as an alternative process to new weapon system acquisition for Air Force modernization requirements. A need therefore exists to review this alternative process as it is practiced today to determine what problems or issues currently confront management and thus require further attention.

Background and Justification

Managerial planning for major system acquisitions is a continuous process not limited to static, one-time projections of hardware costs and assessments of technical

---

[1]Definitions of terminology peculiar to major weapon system acquisition and modification management are contained in Appendix A, "Glossary of Terms."

risks. Repeated taxpayer and Congressional criticism of program delays and cost overruns on prior new system acquisition programs such as the F-111 and C-5 resulted in sweeping policy and regulatory guidance changes which more clearly defined and proceduralized mission need analysis and management planning for acquisition decisions.

In a statement to Congress, General Alton B. Slay, Commander, U.S. Air Force Systems Command (AFSC), responded to the aforementioned criticism stating:

> . . . We have worked to tie mission area analysis, development planning, zero base budgeting and system acquisition into an integrated process [6:23].

To further convey his views on the Air Force's rebuttal of such criticism, General Slay described the analysis and planning interaction, adding:

> This is a new system of analysis which makes it simpler to identify and push high payoff projects at the lowest management level and at the earliest stage in the process [6:23].

In an era characterized by the spiralling costs and longer leadtimes of new systems, complicated by tighter DOD budgets with only nominal real growth (after adjusting for inflation), fewer new systems can be afforded and thus procured. Secretary of Defense Harold Brown stated in his report to Congress on the fiscal year 1980 budget:

> . . . Since the 1960s the cost of modern aircraft increased in real terms by a factor of four while real program funding of recent defense budgets is comparable to those of the early 1960s [14:184].

The affordability problem contributed to the cancellation of the B-1 strategic bomber program and was based essentially on cost considerations. In the opinion of the researchers, that decision left an unsatisfied need for a manned bomber capable of penetrating a potential enemy's air space while carrying the Air Launched Cruise Missile (ALCM), a new system slated to become part of the U.S. nuclear warfare deterrent triad. In place of the B-1, the aging B-52 Stratofortress is being modified to carry the ALCM, a role never contemplated during the B-52's design stage nearly three decades ago. Secretary Brown estimates the B-52 cruise missile force to be approximately 40 percent less expensive than a B-1 force of equal effectiveness, thus qualifying as a high payoff project (14:184).

According to Secretary Brown, modification of existing weapon systems has become "at least an equal alternative" for defense planners and managers (14:184). In view of the Executive- and Congressional-level concern that has been expressed in changed guidance, the use of the modification process as an alternative acquisition strategy has become today's reality.

Modification Categories

There are several different categories of modifications which vary by permanence and end purpose, and the U.S. Air Force classifies them in Air Force Regulation

(AFR) 57-4 Modification Program Approval, for management purposes as follows (19:10-11):

> Class I--A temporary removal or installation of, or change to, equipment for a special mission or purpose.
> Class II--A temporary modification to support research, development or operational test and evaluation.
> Class III--Modifications required to insure production continuity.
> Class IV--Modifications to insure safety of flight, to correct a deficiency which impedes mission accomplishment, or to improve logistic support.
> Class V--Installation or removal of equipment changing the mission capability of the present system configuration.
> Updating Change--Modification requirement other than Class V, prior to program management responsibility transfer from AFSC to AFLC.

Modification Magnitude

In terms of dollar magnitude, modifications represent a significant annual Air Force expenditure and are rapidly accounting for a greater share of USAF funding for modernization purposes. The data portrayed in Table 1 show estimates of hardware costs (exclusive of installation costs) in current year dollars presently in the President's fiscal year (FY) 1980 budget for the three main modification classifications (17:17). Inspection indicates dramatic increases over the next two fiscal years with sustained high levels of activity well into the mid 1980s. The increase from FY 1979 to FY 1980 alone represents a change of approximately 60 percent.

TABLE 1

MODIFICATION BUDGET PROJECTIONS
(in millions of dollars/current dollars)

Year	Class V	Class IV	Update	Total
FY78	419.7	182.4	50.4	652.5
FY79	661.6	210.9	115.3	987.8
FY80	1,141.9	320.0	113.2	1,575.1
FY81	1,409.3	454.2	158.8	2,022.3
FY82	1,202.4	534.0	72.0	1,808.4
FY83	1,115.6	464.1	70.0	1,649.7
FY84	1,096.7	320.4	60.0	1,477.1
FY85	484.2	83.0	•	567.2
FY86	322.7	8.4	•	341.1
FY87	189.9	•	•	189.9
	8,054.0	2,577.4	639.7	11,271.1

•Not available.

SOURCE: [17:17]

Scope Limitation

Referring again to Table 1, the Class V modification portion is consistently at least 60 percent of the total of the budget estimates presented in each of the indicated fiscal years, although the actual number of modifications these funds are programmed for are fewer than the number in either the Class IV or the Update categories.

For the purpose of this thesis, research is restricted to the USAF's management of Class V modifications meeting the definition of a major weapon system acquisition. Thus, of specific interest were modification progams determined by USAF management as critical, requiring large dollar resources and warranting special management attention, which:

> . . . Provide a new or improved operational capability and are required to accomplish an assigned mission that cannot be accomplished with the present configuration [19:11].

Within the category of Class V modifications, those that currently meet the definition of a major system are but five in number and involve four weapon systems: (1) C-141 Stretch/Aerial Refueling; (2) F-4G "Wild Weasel"; (3) EF-111A Tactical Jamming System (TJS); (4) B-52 Offensive Avionics System (OAS); and (5) B-52 ALCM Integration. These five modifications account for over 40 percent of the total Class V budget projections.

Literature Review

Information on major weapon systems acquisition in general, and modification in particular, is available from a wide range of sources. Official regulations, the popular press, academic research, and the people who are employed in the area of interest are all valuable resources.

The initial search for information was based on the following resources:

1. A review of the Reader's Guide to Periodic Literature, Air University Library Index to Military Periodicals, and U.S. Department of Defense Bibliography of Logistics Studies and Related Documents.

2. A search for previous studies, projects, and theses by subject (modification, modification management) from the Defense Documentation Center (DDC) and the Defense Logistics Studies Information Exchange (DLSIE).

3. Directives, Regulations, and Manuals regarding "Acquisition" and "Modifications."

4. Guidance by Air Force Business Research Management Center (AFBRMC) personnel and interviews with managers involved with the major Class V modifications of aircraft weapon systems.

Official directives and policy are available through several agencies, i.e., Office of Management and Budget (OMB) and General Accounting Office (GAO), and

specific activities, i.e., Department of Defense (DOD), U.S. Air Force (USAF), and major commands (MAJCOMS).

One important policy paper on executive branch agency planning for major system acquisition is the Office of Management and Budget Circular No. A-109. This 1976 Circular, based on executive branch consideration of the Commission on Government Procurement's recommended changes to improve the process of acquiring major systems, has been called "one of the most important administration documents in setting out the future defense posture [6:23]." The central thrust of Circular A-109 is to promulgate reforms to the major system acquisition process with the goal of reducing cost overruns and minimizing the decades-old controversy surrounding the need for new systems (11:1). Past practice permitted approving requirements and beginning new programs after selection of system design concepts; Circular A-109 requires that new programs be started only after agency head approval of mission needs and prior to identifying and exploring design concepts (12:4).

The expected impact of the new policy is that both large and small industrial firms will compete earlier to identify and explore alternative system concepts to meet the established mission needs. Rather than responding to a specific technical or equipment requirement for a system to perform a specific task, industry will be

encouraged to investigate innovative design ideas early in the development stages of the time-phased analysis of requirements. The executive agencies to which the Circular is addressed are tasked to: (1) identify the management process for that agency's major system acquisition and monitor implementation of the prescribed policies and practices, (2) reconcile determination of mission needs with overall capabilities, priorities and resources, and (3) explore, solicit and support alternate system design concepts (12).

Several DOD and Air Force directives govern the appropriate response to mission needs. Among these are DOD Directive 5000.1, Major System Acquisition, DOD Directive 5000.2, Major System Acquisition Process, DOD Directive 5010.19, Configuration Management, and AF Regulation 65-3, Configuration Management. The latter two describe the function of identification, control, accounting for, and auditing of the functional and physical characteristics of systems and equipment already operated and supported by DOD.

AF Regulation 800-2, Acquisition Program Management (15), specifies that modification programs are to be managed as other acquisition programs as much as possible, and in accordance with Secretary of Defense directions. There are several accompanying 800-series AF regulations, all dealing with aspects of acquisition management, but

not addressing modification management issues directly. For instance, AFR 800-3, Engineering for Defense Systems, states, simply:

> AFLC . . . assures engineering integration, on a total system basis, for weapon system modifications after program management transfer (AFR 800-4) or as prescribed in AFSC/AFLC agreements [18:5].

AFLC and AFSC each currently have command-unique guides for program management, which are somewhat redundant in their description of the acquisition process, (but not necessarily including specific information concerning modification management). AFLC/AFSC Pamphlet 800-34 (DRAFT), Aquisition Logistics Management (16), addresses areas common to both commands and includes a chapter specifically on Class V modifications.

Air Force Regulation 57-4(C-1), Modification Program Approval (19), prescribes the procedures for planning, documenting, and obtaining approval of a modification for all Air Force, Air Force Reserve, and Security Assistance activities for which the Air Force has logistic support responsibility. The regulation interprets the allowances for modification to Configuration Items (CI), and classifies the modifications by requirements and Program Management Responsibility (PMR). As the primary AF document on modification, AFR 57-4 delineates the functions, restrictions, and responsibilities of Headquarters USAF and the major acquisition commands, Air Force

Logistics Command (AFLC) and Air Force Systems Command (AFSC), for accomplishment of this form of modernization. Terminology peculiar to modification management, but extraneous to the basic acquisition process, is explained in the Regulation (see Appendix A).

Headquarters USAF must evaluate all Class V modifications which are proposed as solutions to validated Statements of Operational Need (SONs) submitted by the operating commands. USAF may disapprove, return for resubmission, investigate funding and/or costing information, and/or direct the appropriate MAJCOM to assist and support any Modification Proposal and Analysis (MPA). A Program Management Directive (PMD) is the official Headquarters USAF document required for authorization, direction, and guidance of Class V modification programs. It is also used to request analysis, such as MPA or Modification Program Management Plan (MPMP), and to track and prioritize the requirement.

Headquarters USAF may authorize either AFLC or AFSC to manage a Class V modification. Most in-service weapon system modifications are directed to AFLC for management, with AFSC in a supporting role. However, if Program Management Responsibility Transfer (PMRT) to AFLC has not yet occurred, or if extensive design development (particularly engineering) is required, the PMR will be assigned to AFSC (19).

Command-unique and joint-command regulations are important to the modification program manager. In a concurrent study by Captain Richard S. MacIsaac, USAF, AFIT/LS, Class 79B, the modification management process, related guidance, and "lessons learned" are provided for the AFLC Program Manager of major production Class IV and V Modifications (10). This manager serves both of the acquisition commands during the process. After extensive review of current guidance and interviews of USAF and industry managers, Captain MacIsaac has presented a handbook of alternative management approaches for Class IV and Class V modification programs. Because of his interest in the modification management process and Class V modificatons, portions of Captain MacIsaac's research parallel and complement issues identified in this thesis.

A 1977 study project report by Lieutenant Colonel Reginald M. Cilvik (5), "Class V Modification Management and Planning: A Guide for the AFSC Program Manager of Less-Than-Major Systems," provides a concise description of the procedures and the AFLC/AFSC interface in the modification area. Through research and interviews, Lieutenant Colonel Cilvik identified problems in modification management and provided broad guidelines to the AFSC Program Manager (PM) for minimizing intercommand conflicts. This guidance, however, recommends awareness, foresightedness, and flexibility. The project conclusions

recognize the complexity of even less-than-major programs, the dilemma in assignment of management responsibility and the hoped-for contributions of the Air Force Acquisition Logistics Division (AFALD) toward command interface. Lieutenant Colonel Cilvik recommended additional study "to determine if improvement in existing management procedures or organization structure is possible [5:39]" and to evaluate how complex integrated logistic support can be better accomplished.

Closely related to Cilvik's study was the effort of Captain Terry L. Balven, "Acquisition of Class V Modifications" (3). In this AFALD-sponsored project, Captain Balven enumerated eleven issues that focused on deficiencies in the four broad areas of managerial planning, control, procedures, and modification development and implementation. Each issue contained an individual conclusion and recommendation that support a proposed solution to the multifaceted problem.

The Department of Defense acquisition expenditures provide an excellent subject for the popular media. Often articles provide information on a specific system or recent Congressional activity. The dollars spent or appropriated receive particular attention. Industry periodicals, such as Aviation Week and Space Technology, frequently provide objective information on modernization expectations and costs. In-service publications are also

good sources. The Air University Review recently published an article, "The Ever-Changing Fleet," by William G. Holder which describes several current modification programs in an interesting narrative and includes photographs of the systems (8). A fascination with the significant funds allocated for aircraft systems results in the popularity of books such as Berkeley Rice's, The C-5A Scandal and Robert F. Coulam's The Illusions of Choice--The F-111 and the Problem of Weapons Acquisition Reform. The hindsight available in these studies can be informative to contemporary decision makers.

The primary source in a study of the planning and procedures that go into modification management are the managers themselves. These individuals are in the best position to describe their perceptions of the responsibilities and problems that exist at various levels of planning, implementation, and control. The discovery and discussion of issues or problems, and the resulting recommendations, models, and guidance have all been developed by direct contact with the managers. Using a synthesis of the issues and problems found in the Cilvik and Balven studies as a baseline, this research contributes to the body of knowledge on the Class V modification process by adding the views of the people involved in the management of major Class V acquisitions.

Research Objectives

The objectives of the research were to:

1. Develop a current annotated bibliography of studies and guidance regarding Class V modification management.

2. Identify and compare existing models that have been developed to describe the Class V modification management process.

3. Identify outstanding issues or problems in the area of managing Class V modifications that are considered important by the managers.

Research Questions

1. What research and direction is available regarding Class V modification management?

2. What basic descriptive Class V modification management process models exist, and how may they be used?

3. What issues or problems are outstanding and considered important to managers involved in the Class V modification management process of major systems?

Organization of the Study

The following chapter describes the research design adopted to answer the three Research Questions. Research Question One is addressed by Appendix D, "Annotated Bibliography." Chapter III, "Modification Management Process," answers Research Question Two.

Chapter IV, "Analysis and Interpretation of Managerial Opinions," provides an analysis of manager inputs from interviews to address Research Question Three. A Summary and Conclusions are presented in Chapter V.

CHAPTER II

RESEARCH DESIGN

Nature and Sources of Information

In addressing the three Research Questions, two methods of information collected were selected: First, an extensive literature search, and second, a series of personal interviews. As noted earlier, the large dollar expenditures for DOD weapon system acquisition, and the increased emphasis on hardware modification as an alternative, have made this subject highly visible. Early in the decade influential personalities, formal studies, and popular literature called for more information and guidance on the topic of modification management and procedures. Some progress has been made in recent years, but no centralized, annotated bibliography is available of existing studies and current, appropriate guidance to facilitate ongoing and future research of this topic without repeating prior research. Thus, Research Question One, a collection of these resources, is addressed by the Annotated Bibliography in Appendix D.

Similarly, early studies indicated a need for a comprehensive description of the modification management process. Robert P. Lavoie (9:12) calls "forcing major

modification decisions into the same process as new systems" the latest trend. More recently, however, the realization that most Class V modifications do not match the process for new systems has resulted in a wealth of modification management models. Both extensive descriptions of the Class V modification process and suggested flow diagrams have been developed. Because of the simplicity and flexibility of the diagrams, three types of these models have been selected for presentation, discussion and comparison to meet Research Question Two. The models and their descriptions are from the literature search, which also provided the expertise and background for addressing Research Question Three.

Existing literature, such as the Cilvik and Balven studies, has provided issues that require further research, formal direction, or correction. For example, one issue frequently mentioned was the need for a modification management process model, which is addressed by Research Question Two. In an effort to confirm the currency and applicability of these existing issues and discern others not previously documented, the researchers asked managers of four major system programs in AFSC and AFLC for their personal opinions.

The major resource was the modification managers themselves, at the staff levels and at the field system program or system management level. These managers have

a first hand understanding of problems and issues and could readily address the specific rationale behind the issues of concern to them.

A judgemental selection of twelve managers was made to form a sample which was approximately evenly distributed between the line and staff organizations within the two commands. The sample was considered to be reliable since the managers selected represent programs that make up all of the currently authorized major USAF Class V modifications. The programs of interest are: (1) the C-141 Stretch/Aerial Refueling modification and (2) the F-4G "Wild Weasel," both assigned to AFLC for primary management responsibility; and (3) the EF-111A Tactical Jamming System (TJS) and (4 and 5) B-52 Air Launched Cruise Missile (ALCM) Integration and Offensive Avionics System (OAS) modificatons, all assigned to AFSC. Brief summaries of these programs, and the managerial positions contacted, may be found in Appendix B; the Interview Guide is in Appendix C. Although position title and office designation is noted, anonymity in relation to specific responses was retained.

Data Collection Techniques

Literature Review for Annotated Bibliography

As previously noted, the initial resource search included:

1. A review of the Reader's Guide to Periodic Literature, Air University Library Index to Military Periodicals, and U.S. Department of Defense Bibliography of Logistics Studies and Related Documents.

2. A search for previous studies, projects, and theses by subject area from the Defense Documentation Center (DDC) and the Defense Logistics Studies Information Exchange (DLSIE).

3. Directives, Regulations, and Manuals regarding "Acquisition" and "Modifications."

These sources provided significant information regarding existing guidance, studies, and recommendations.

Class V Modification Models

When the size and complexity of the Department of Defense's major weapon system acquisitions became apparent, a desire for descriptions and models of the process occurred. Although some direction (15) specifies that modification programs are to be managed as much like other acquisition programs, as possible, experience has shown this to be difficult (2:6-7). Several descriptions of the Class V modification management process have been developed, and a wide range of model types are now available:

--Air Force Regulation 57-4 (19) is the primary source of information for the responsibilities and functions related to planning, documenting, and obtaining

approval of AF modifications, but this document does not provide a chronology of events or a process flow diagram.

--A mathematical systems approach model of the procurement process, which could be adapted to unique or complex activities applicable to modification management, is presented by Richard S. Sapp (13).

--Reginald M. Cilvik (5) relates the specific position of the Class V procedures within the standard DOD Planning, Programming and Budgeting System (PPBS).

--Chapter 26, "Class V Modifications," of the draft AFLC/AFSC Pamphlet 800-34, Acquisition Logistics Management, (16) provides definitions of and discussion about modifications, alternative models (related to differences arising in the process) and a detailed description of the most common method, including exceptions and examples.

--In order to research the understanding of responsibilities of organizations involved in the AF modification program, D. E. Haslam and C. C. Berger (7) have developed diagrams for Class IV, Class V, and Updating Changes. They specifically attempted to display the possible organizational interfaces required by the process.

--A Headquarters AFLC/LOA briefing (1) displays the process from the AFLC viewpoint. This briefing charts the chronology and specific interfaces, and is simple and direct for ease of understanding.

Interview Procedures

In previous studies the personal interview provided substantial input for procedural evaluations, process modeling, and recommendations. In some cases, such as the Chapter on Class V modifications developed for AFLC/AFSCP 800-34, no information regarding contacts with recognized experts is available, since this was the result of an "in-house" staff study and interpretation. Other works provide a collection of resources (5; 9); the most comprehensive projects provide a good bibliography, plus an analyzed and tested interview guide or questionnaire (4; 7). This project used the guided interview approach to evaluate the currency of previously identified modification management issues and problems from the Cilvik and Balven studies as they relate to major Class V modifications and solicited additional issues as appropriate. The structure and content of the interview guide was reviewed and pretested by specialists in the field prior to actual data collection. This was done to minimize or eliminate ambiguity or research bias.

As indicated, the population of modification managers involved in major Class V modification programs was represented by AFLC and AFSC staff and line organizations. Several pertinent issues were drawn from the aforementioned studies and structured as statements. The desired outcome was to confirm or refute each statement as being

an issue or problem applicable to managers of major Class V modifications. Each manager was asked to respond to the statement with one of five degrees of agreement (strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree); in all cases, the respondent was given the opportunity to elaborate on or explain his chosen response in detail. Also, an open-ended request for additional issues or problems not specifically addressed in the guide but considered important to the manager was invited.

Data Analysis

Research Question One

What research and direction is available regarding Class V modification management?

The literature search provided three types of resources. The first was popular literature--books and periodicials. These resources provided a background and an indication of the subject's timeliness. In most cases, however, brevity, simplification, or the author's editorializing weakens their credibility as research expertise. The second type of resource is the broad spectrum of studies, theses, and staff projects. Because of the researcher expertise, the depth of research, the breadth of contacts or the objective of the contribution, such studies are assumed to have a great deal more credibility. The annotated bibliography of this project includes those

studies which are: (1) referred to frequently by managers or other studies; (2) recent and timely; or (3) contribute to the study of this topic with methodology or background information. These select sources are presented in chronological order in Appendix D. Formal guidance is the third resource, and credibility is assumed. A comprehensive listing of those publications which regulate, direct, or guide the modification manager, including most recent publication dates, titles and synopses, are also found in Appendix D.

Research Question Two

What basic descriptive Class V modification management process models exist, and how may they be used?

The models reviewed were found in the latter two literature sources just described--studies and formal guidance. Several models were reviewed and analyzed and included based on (1) the purpose, developer, use and user, (2) the completeness of the narrative description available and, (3) the clarity of the "picture" accompanying the narrative. Three different representative model types are presented and briefly described in Chapter III. Based on information provided with the models, the literature search, and interviews, these three model types are compared and discussed in terms of application and adaptability.

Research Question Three

What issues or problems are outstanding and considered important to managers involved in the Class V modification management process of major systems?

The interview guide was structured for obtaining opinions on several issues. Questions 1 through 4 were designed to obtain a minimum essential amount of demographic information on each respondent. The purpose of these four questions was to obtain the working experience, background, and program longevity data necessary to inform the researchers about the extent of the individual's involvement in modification management. This was done to validate the respondent as a credible source of information.

Statements 6, 7, 10, and 15 sought inputs on the respondent's impressions of the adequacy of existing regulations, directives, and guidance. Responses of strong disagreement with 6, 7, or 10 would indicate the presence of a problem; strong agreement with 15 would cite the need for a change in the current policy of managing each modification individually.

Issues relating to management authority, responsibility and effectiveness were addressed by statements 8, 12, 13, 18, and 19. Disagreement with the first three would support earlier findings showing problems arising from fragmentation of authority and responsibility within

a command and between commands. Responses in either direction to statements eighteen and nineteen would give insights into the manager's perceptions of the degree to which other organizations do or should become involved with the ongoing management of the respondent's program.

Statement 16 seeks an assessment from the respondent as to where greater emphasis should be placed in understanding the Class V process. Funding peculiarities were treated by statement 11, which would indicate serious concern to the manager. Statements 5, 9, 14, and 20 compared the respondent's attitudes on the use of the Class V modification process as an alternative to the more traditional new systems method of acquisition. Strongly held opinion responses to these statements would demonstrate the manager's degree of acceptance of the modification process.

Finally, statement 17 was designed specifically to obtain agreement or disagreement with the major problem areas discovered in Captain Terry L. Balven's study (3), namely: concurrency, system integration, and management approaches.

Findings are presented and analyzed in Chapter IV, with the corollary findings resulting from information voluntarily offered by respondents.

Finally, the three Research Questions directing this project are reviewed in Chapter V. A summary of how

each Research Objective has been addressed is included, as well as the researchers' conclusions and recommendations regarding modification management in general, and major Class V modification program management in particular.

CHAPTER III

MODIFICATION MANAGEMENT PROCESS MODELS

Addressing Research Question One, "What research and direction is available regarding Class V modification management?" helped to fulfill two of this project's Research Objectives. The first, to develop a current annotated bibliography of studies and formal guidance regarding Class V modification management, was met by the collection and review process that resulted in Appendix D, "Annotated Bibliography."

That review provided the background for answering Research Question Two, "What basic descriptive Class V modification management models exist, and how may they be used?" This chapter identifies and compares existing models that have been developed to describe the Class V modificaton process, which is Research Objective Two.

In 1974, the General Accounting Office (GAO) published a summary of a survey on the process by which the Department of Defense identifies mission needs and establishes requirements for major weapons systems. The Foreword to that report (20) indicates that it

> . . . presents the first compilation of all aspects of the formal requirements process and its relationship to the Planning, Programming and Budgeting System

(PPBS) and the Defense Systems Acquisition Review Council (DSARC).

Noting that the "informal process is for the most part indefinable," the formal process, including "all documents, reviews, and briefings that by regulation or directive should occur during the initiation, review, and approval of a major weapon system acquisition," is provided in detail by GAO for DOD and the Services.

In 1976, the Office of Management and Budget (OMB) and the Office of Federal Procurement Policy (OFPP) issued a new policy for the acquisition of major systems by all executive branch agencies as OMB Circular A-109. The requirement for improved attention to the determination of agency mission needs and goals and the logical sequence of activities and events in the major system acquisition process was adapted to DOD's formal actions. The DOD specific policy and procedures for the major system acquisition process are set forth in DOD Directives 5000.1 and 5000.2.

With the implementation of OMB Circular A-109, OFPP released OFPP Pamphlet No. 1, which reviews the "Major System Acquisition Cycle." Figure 1 (11:4) illustrates the basic process or cycle, with the boxes describing the phases of activities and the numbered circles indicating the major decision points.

It is from this basic model, and the DOD specific mission needs for weapon systems, that the requirement for guidance on the alternative solution to an operational

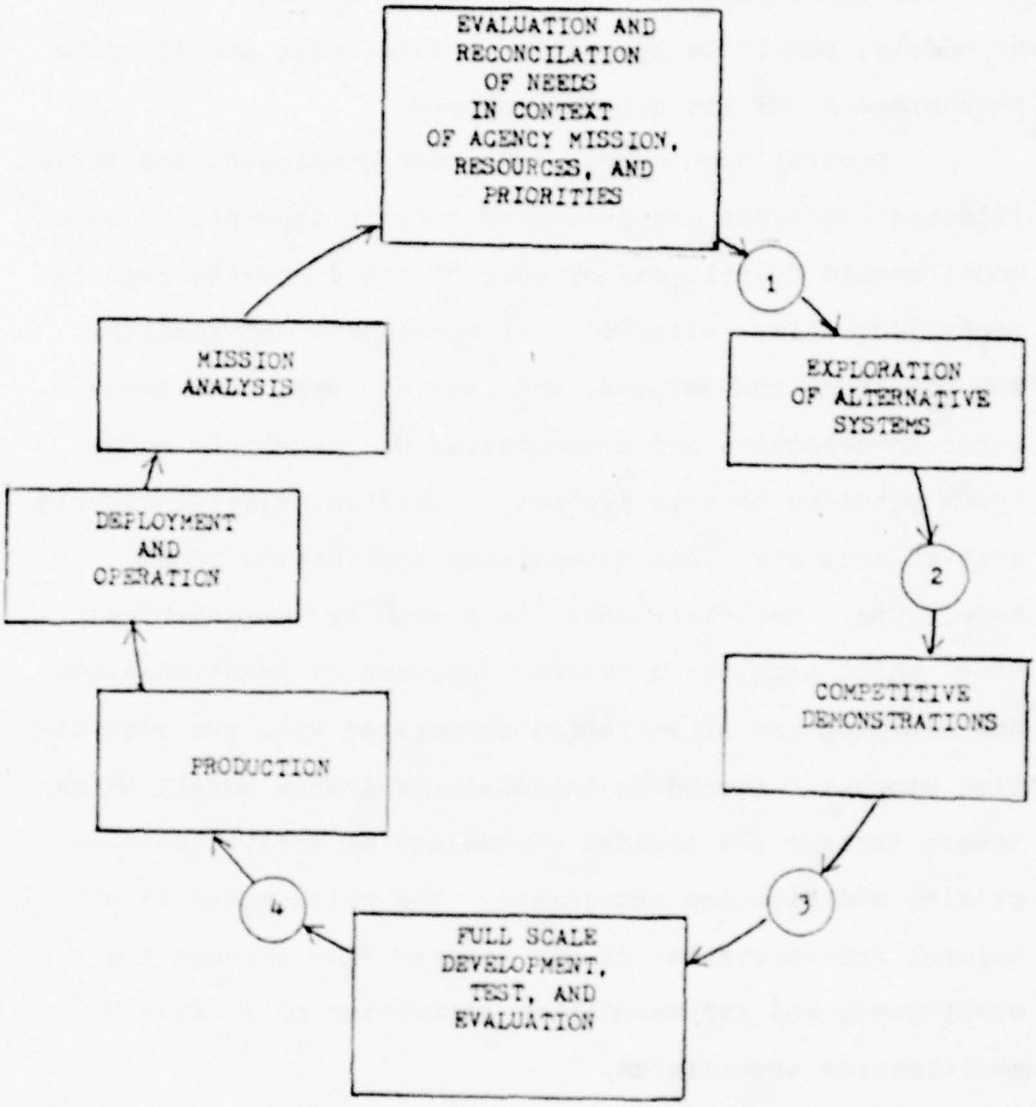

Fig. 1. Major System Acquisition Cycle [11:4]

need through modification is derived. Ideally, a model, or models, should be available to illustrate and describe this process and its unique features.

Several such models have been developed, and three illustrative types are presented in this chapter. A good model should fulfill one or more of the following requirements: education, direction, or management information. The developer and purpose, and user and use, were evaluated in selection and presentation of the sample model types provides in this project. Likewise, similar citeria must be evaluated when determining application of any model type. The first model is a complex, mathematical model which provides a systems approach of identification and manipulation of variables associated with the acquisition process. Second is the chain-of-events model, which tracks through the typical chronology of activities comprising modification management. The third model is a general interpretation of the program flow through the development and implementation activities of a Class V modification acquisition.

A Systems Approach

Richard S. Sapp (13) used a systems approach to view the process by which the Department of Defense acquires and modifies its major weapon systems. Systems diagramming was used to develop a model of the

procurement[2] process, to demonstrate the multiplicity of relationships affecting defense budgets, and to develop a scheme for classifying causes of program cost outcomes. From an examination of two case histories (the C-130 Center Wing Class IV modification, and the B-52G and H Stability Augmentation System Class IV modification), Sapp concluded that "large modification programs requiring Headquarters USAF involvement exhibit the basic characteristics of major weapon systems acquisitions [13:40]." Just as he used the diagrammed model to develop mathematical models to address modification program costs, these models can be constructed to apply to other modification management procedure subjects, such as timeliness, efficiency, or communication.

Figure 2 (13:48) portrays a general, simplified procurement model with four systems defined: the Using Command, the Government Buying Office, a Headquarters, and the Contractor. Each system has internal activity and external interfaces.

Next, Figure 3 (13:45) represents one system and its relationship to the total environment. Each system is composed of three internal components: (1) A control device, which makes decisions (on the design of the process and evaluator, and on the control of the process)

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[2]The term procurement as used here is synonymous with acquisition.

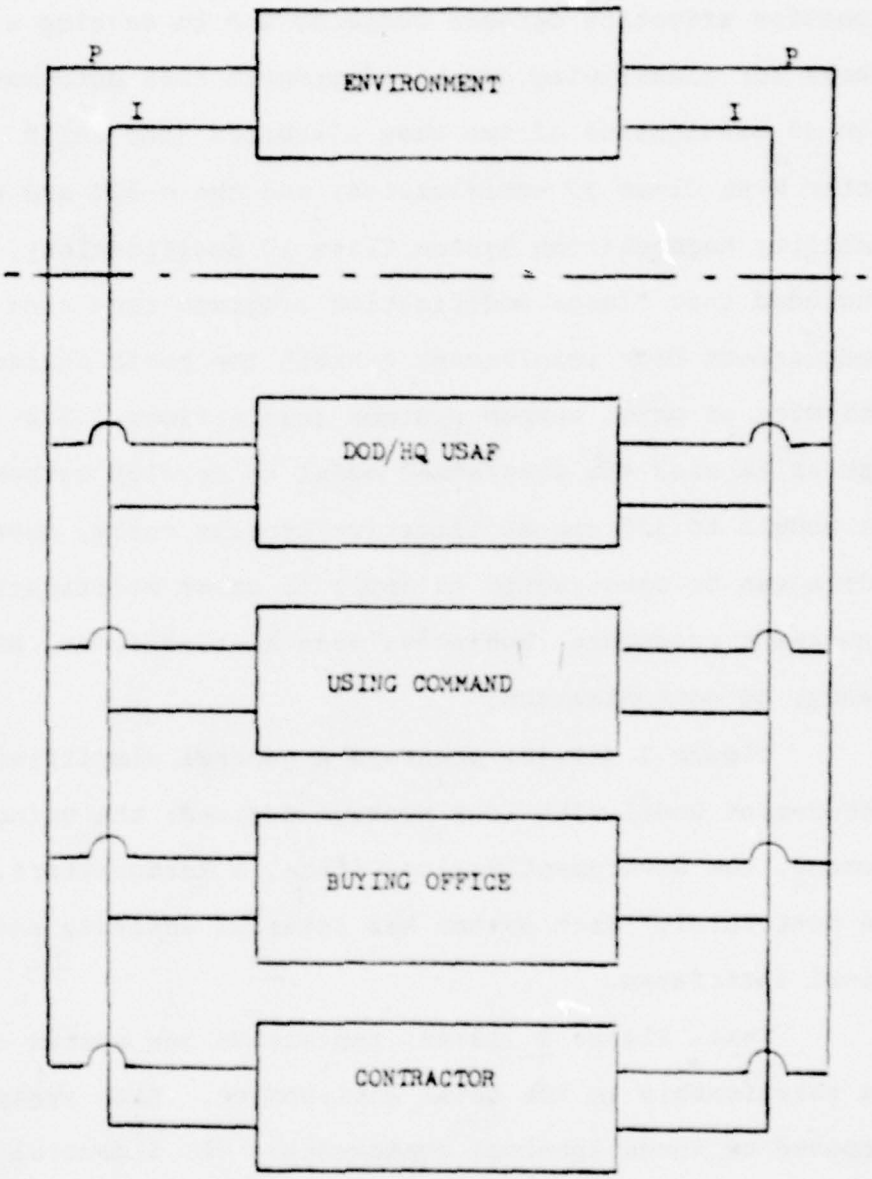
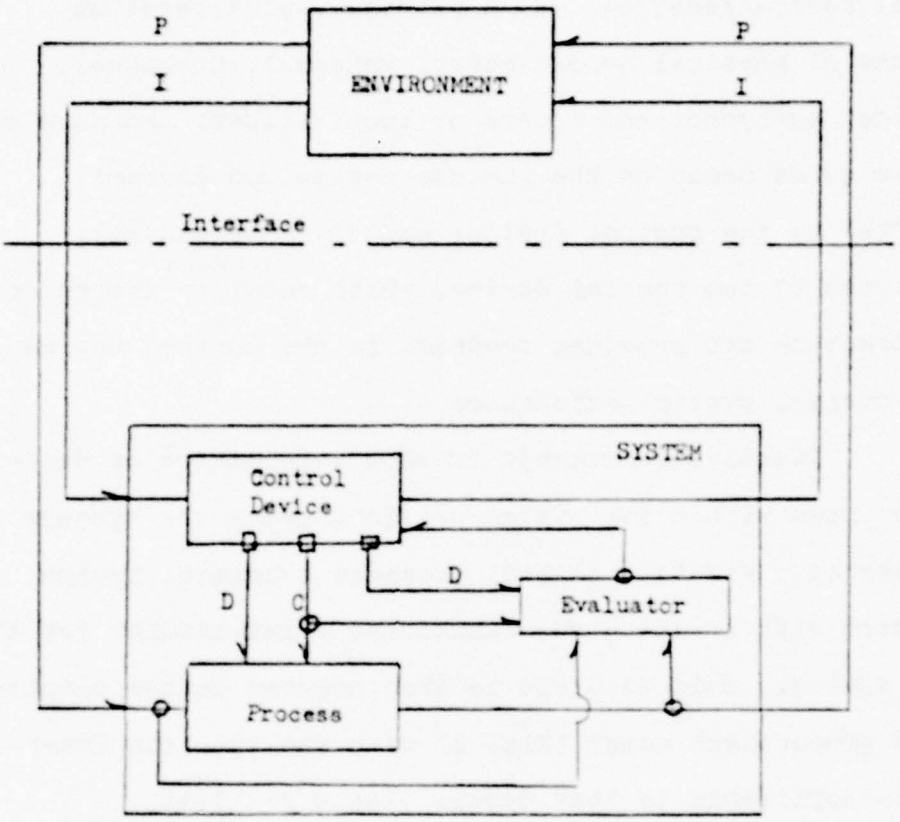


Fig. 2. Four System Procurement Model
[13:48]



Notation:
P = Physical Flow
I = Intelligence Flow
□ = Decision: D = Design, C = Control
○ = Information Tap

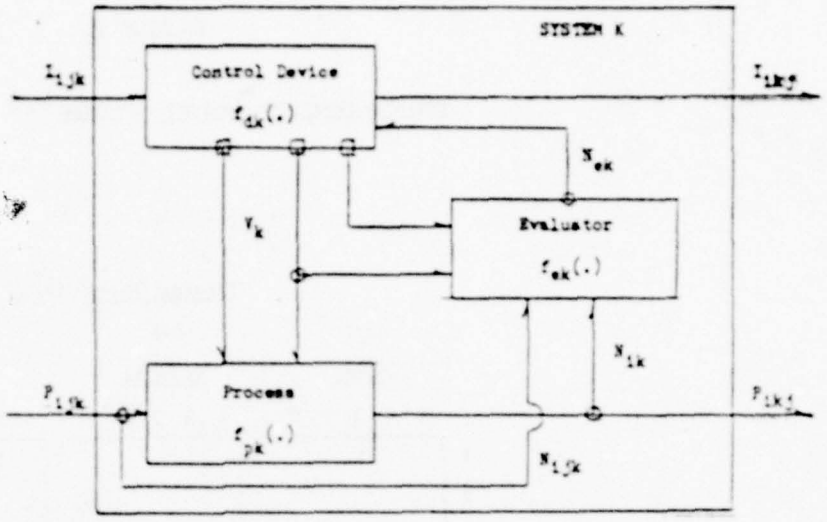
Fig. 3. Generalized System Diagram

[13:45]

and generates intelligence based upon information and intelligence received; (2) A process, which receives inputs of physical goods (money, material, personnel, capital equipment and orders or requisitions) and puts out these goods based on the process design and control exerted by the control device; and (3) An evaluator, designed by the control device, which receives inputs of information and provides feedback to the control device on the overall system performance.

Finally, an attempt to show information or decision flows within the system or flows among the systems is presented. Figure 4 (13:50) presents a general system diagram with notation and functional relationships for the k^{th} system. This notation is then adapted to the simplified procurement model (Fig. 2) with the specific interfaces applicable to that model. Table 2 (13:51)

> . . . . describes in matrix form one possible respresentation of the physical goods flow patterns which can exist among the systems and environment for the four system model. A blank, or zero, indicates no flow, a one (1) indicates a flow. For example, $P_{113} = 1$ implies a flow of money (i = 1) occurs from DOD/HQ USAF (System 1, j = 1) to the Buying Office (System 3, k = 3). In a similar fashion flows of intelligence can be evaluated. As an example, say the development of a weapon system by an unfriendly nation poses a new threat. Table 2 also depicts this intelligence flow with the same four systems. $I_{134} = 1$ implies intelligence on the threat (i = 1) flows from the Buying Office (System 3, j = 3) to the Contractor (System 4, k = 4). Another example of an intelligence flow would be knowledge of fund levels and availability in other systems [13:49].



Notation:

$f(.)$ - function

f_{pk} - process function of kth system

f_{ek} - evaluator function of kth system

f_{dk} - decision function of kth system

- $(f_{d1k}, f_{d2k}, f_{d3k}, f_{d4k})$

I_{ijk} - intelligence flow of ith type from system j to system k

P_{ijk} - physical flow of ith type from system j to system k

V_k - vector of control variables for kth system

N_{ek} - information from kth system evaluator

N_{ijk} - information to evaluator on ith type physical flow from system j to system k

N_{ik} - performance information to evaluator of ith type on kth system

Functional Relationships:

$I_{ikj} = f_{d1k}(I_{ijk}, N_{ek})$ $\quad f_{pk} = f_{d2k}(I_{ijk}, N_{ek})$

$N_{ek} = f_{ek}(V_k, N_{ijk}, N_{ik})$ $\quad f_{ek} = f_{d3k}(I_{ijk}, N_{ek})$

$P_{ikj} = f_{pk}(P_{ijk}, V_k)$ $\quad V_k = f_{d4k}(I_{ijk}, N_{ek})$

Fig. 4. Generalized System Representation [13:50]

TABLE 2

PROCUREMENT MODEL FLOWS[1,2] [13:51]

Physical Flows[3] (P_{ijk})

	i=1 Money					i=2 Material					i=3 Orders				
	1	2	3	4	E	1	2	3	4	E	1	2	3	4	E
1			1									1	1		
2										1	1		1		
3				1							1	1		1	
4					1		1								1
E	1							1							

Physical Flows[3] (P_{ijk}) Intelligence Flows[3] (I_{ijk})

	i=4 Personnel					i=5 Equipment					i=1 Enemy Threat				
	1	2	3	4	E	1	2	3	4	E	1	2	3	4	E
1		1	1	1	1							1	1	1	1
2	1		1	1	1				1		1			1	
3	1	1		1	1									1	
4	1				1		1			1					
E	1	1	1	1					1		1	1			

Note 1. System 1 = DOD/HQ USAF

System 2 = Using Command

System 3 = Buying Office

System 4 = Contractor

E = Environment

Note 2. Only flows pertinent to the program under contract are considered.

Note 3. k = abscissa, j = ordinate.

Sapp suggested that other systems, such as subcontractors, the public, industry in general, the Administration, and Congress could be added to make the model more complete. When considering major modification programs the two MAJCOMs, AFLC and AFSC, should be included. AFLC's Air Logistics Centers and AFSC's product divisions (e.g., Aeronautical Systems Division) would be desirable additions, perhaps as subsystems. The model could become quite complex, but it does appear to provide a sophisticated capability to include the program-by-program differences the literature and interviews suggest.

Other models are available which are more visual and direct, such as the chain-of-events type which is described next.

Chain of Events

In contrast to the systems approach to the modification management process Sapp offered, a much simpler model was provided by HQ AFLC/LOA (Directorate of Aerospace Systems) (1). The description accompanying the model covered the various classes of modifications, the basic policies and procedures under which the program operates, the organization and operation of the ALC and HQ AFLC Configuration Control Boards (CCB), and examples of the magnitude of the modification program. Class IV modifications and Class V modifications were

emphasized because of AFLC's typical involvement and responsibility, and the large amount of funds dedicated to these programs.

Figure 5 (1:Chart 8) depicts AFLC Class V Modification Processing. The flow begins in the lower left corner with the identification of a requirement and moves toward the top--approval and funding. The right side of the chart, moving downward, illustrates the accomplishment of the modification.

(1) The first step is the identification of a requirement for a capability to perform a mission that is not currently being performed. The user prepares a statement of operational need (SON) stating the required capability which may or may not result in a modification. The SON is submitted to Headquarters USAF in accordance with AFR 57-4. At this time each major command involved prepares formal comments. If an alternative solution to the SON is very likely a Class V modification, and adequate data is available, the command having program management responsibility, AFSC or AFLC, will provide budgetary cost information (BCI) to Headquarters USAF. Budgetary cost information contains preliminary cost estimates and schedules to aid in the decision as to whether or not to pursue the program. This decision is made by the Requirements Review Group (RRG) at Headquarters USAF.

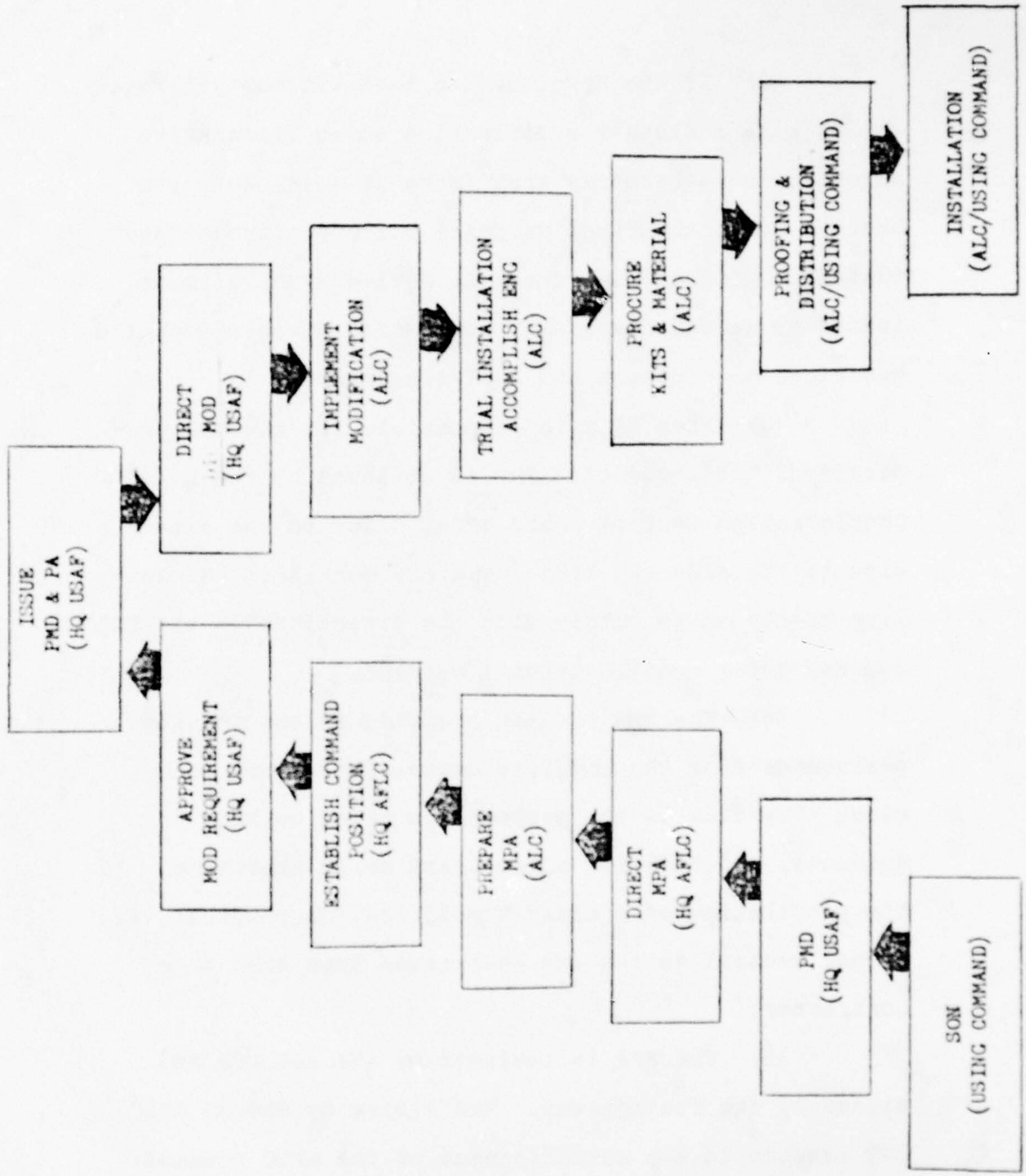


Fig. 5. AFLC Class V Modification Processing
[1:Chart 8]

(2) If the Requirements Review Group validates an SON with a Class V modification as an alternative solution and determines that there is reasonable probability that the final proposal will be approved and funded, a program management directive (PMD) will be issued by Headquarters USAF requesting preparation of a modification proposal and analysis (MPA).

(3) When AFLC is responsible for the MPA preparation, the requesting PMD is reviewed by the HQ AFLC Configuration Control Board (CCB) prior to the direction to the affected ALCs. The CCB considers the ability of the SM to comply with the directions in the PMD and may offer some additional guidance.

(4) The MPA is then prepared by the SM with assistance from the involved organizations and agencies. The data in the proposal is based on PMD guidance, modification policy, and SM/IM expertise. In the preparation of a Class V modification proposal, it is not unusual to require assistance from AFSC or a contractor.

(5) The MPA is reviewed by the ALC CCB and signed by its Chairperson. The review by the HQ AFLC CCB results in the establishment of the AFLC command position on the proposal. The MPA is then forwarded to Headquarters USAF for approval and funding.

(6) - (7) When the modification is approved at Headquarters USAF, an implementing PMD is issued, outlining the tasks to be accomplished and assigning specific responsibilities. At this time program authorization (PA) and funds are made available.

(8) This implementing PMD is also reviewed by the HQ AFLC CCB when AFLC is the implementing command. The affected ALCs are then directed to accomplish any tasks that may be required.

(9) - (11) Engineering and trial installation are completed to determine the final configuration of the modification. When the trial installation is successful, kits and materials are acquired from a contractor or manufactured and assembled by the depot(s).

(12) - (13) Proofing is then accomplished by installing the first production kit along with the time compliance technical order (TCTO) to assure that the hardware and instructions are satisfactory to permit kit installation. When proofing is complete, kits are distributed to activities designated for installation, and the modification is accomplished.

This model is direct and easy to visualize and understand. The narrative is a straight-forward description of the process as it occurs within AFLC. This, however, points to an issue that one must consider if using a model: the developer and his purpose.

In their more general chain-of-events model reflected in Figure 6, D. E. Haslam and C. C. Berger (7:35) do not specifically address the activities within AFLC (although their narrative broadly states that AFLC and AFSC accomplish analysis during USAF evaluation). However, their model illustrates the possible combinations of management duties shared among the ASD SPO/AFLC SM/Using Command (blocks 4-9) during the process.

The chain-of-events model illustrates the chronology of activities but does not adequately show the breadth and complexity associated with major Class V modification programs. The more general models which are presented next provide more flexibility of that nature.

Program Flow

The Air Force Acquisition Logistics Division (AFALD) has been reviewing and preparing guidance on Acquisition Logistics Management in the AFLC/AFSC Pamphlet 800-34. One chapter has been prepared "to describe the general considerations involved in managing the acquisition of new systems or equipment as Class V modifications to existing systems/equipment [16:p.26-1]." The description begins with a discussion of several ways in which the development and implementation

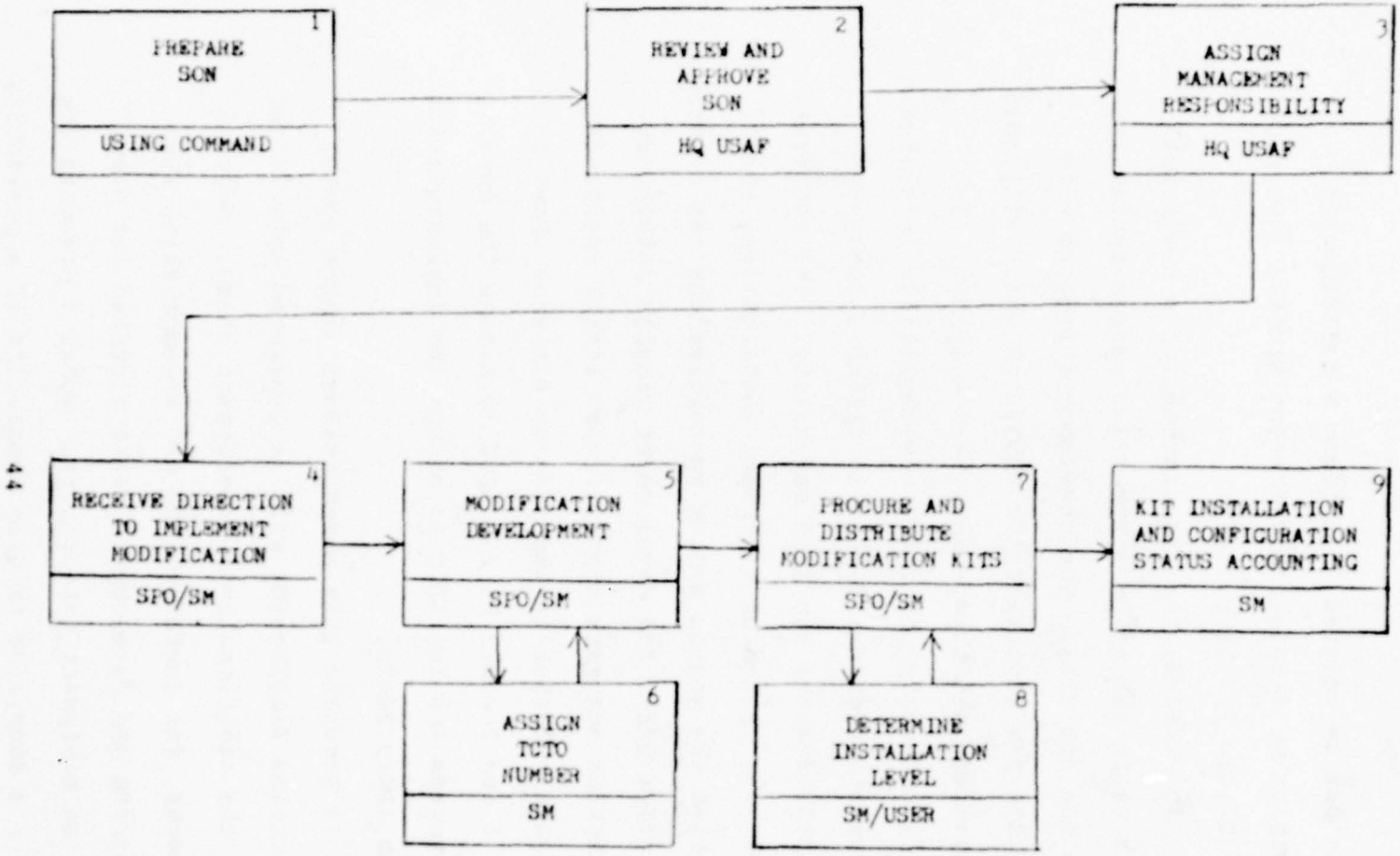


Fig. 6. Class V Modification Processing [7:35]

efforts can be related in a Class V modification acquisition by displaying different program flow patterns (Figure 7) (16:p.26-5).

In Model 1, the requirement for a new capability to be installed on a specified weapon system initiates the activity. The development program will define the new capability or subsystem which will then be installed in the receiving weapon system. In Model 2, a requirement for a new capability initiates a development program intended to define a subsystem which provides the required capability. The requirement for the system or equipment modification, which identifies the weapon system to receive the new capability, comes after the development program initiation. The pamphlet suggests that the most likely assignment of responsibilities in the program patterns shown in Models 1 and 2 would be for AFSC to manage the development program and for AFLC to manage the implementation program (16:p.26-7).

It is possible that an additional weapon system modification requirement will be generated late in (or after) the modification's development stage. Model 3 represents, for instance, the SPO accomplishing the engineering and development tasks required for subsystem or equipment integration. Model 4 presents the flow for a subsystem program consisting of a previously

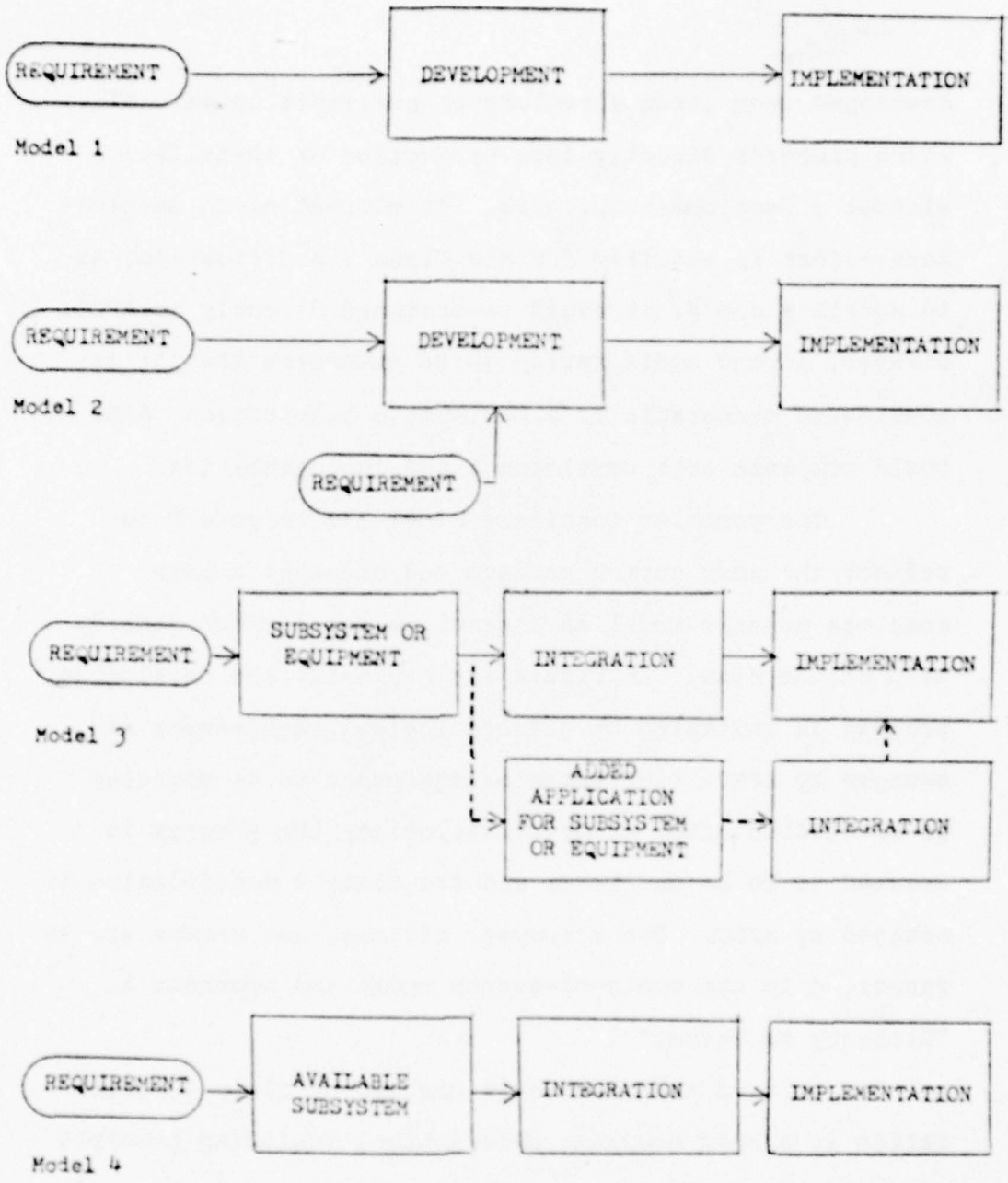


Fig. 7. Modification Acquisition Program Flow
[16:p.26-5]

developed item (from inventory or available commercially) which proceeds directly into production or installation without a development program. If minimal or no development effort is required for the Class V modification, as in Models 3 and 4, it could be assigned directly to AFLC. However, if the modification is so extensive that it is considered comparable to a new system acquisition, AFSC could complete both development and implementation.

The pamphlet considers Model 2 of Figure 7 to reflect the most common pattern and presents a more complete generic model as a baseline for further description of the flow. In Figure 8 (16:p.6-12) the development program is initiated by a technological requirement and managed by AFSC; the system or equipment to be modified is identified after program initiation; the program is assumed to be beyond PMRT; and the Class V modification is managed by AFLC. The acronyms, offices, and groups are as described in the chain-of-events model and Appendix A, "Glossary of Terms."

The bulk of the pamphlet's chapter on Class V modification is a very complete description, including possible deviation from the Requirements Process, Programming and Budgeting, Approval Process, Development Phase, and Implementation Phase. These process phases are noted on the model to illustrate when the diagrammed procedures usually occur. The mixed benefits of general models for

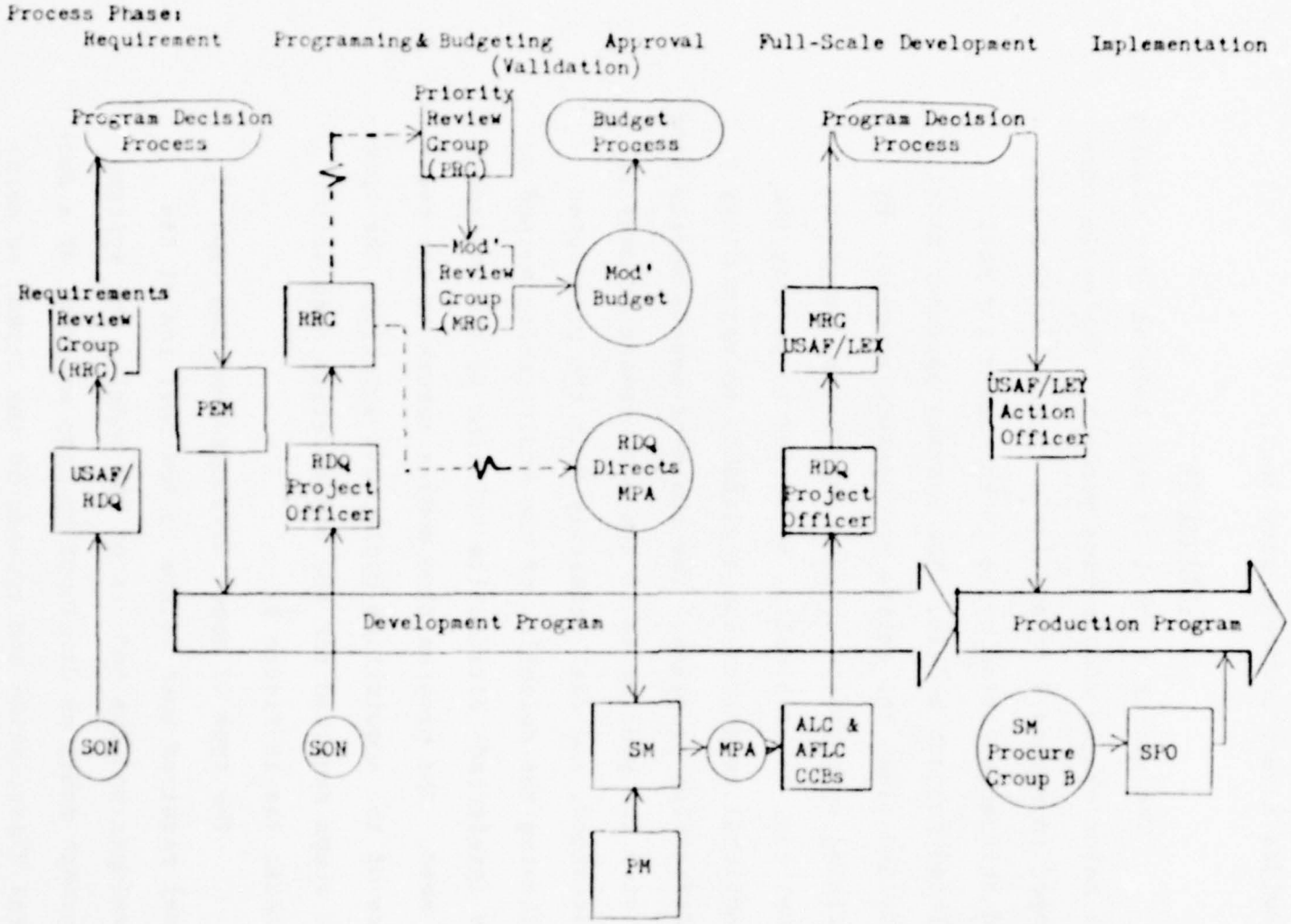


Fig. 8. Modification Acquisition Process [16:p.26-12]

an overview, and more precise information in the narrative provides a very comprehensive tool.

Conclusions

The use of a model is very helpful when viewing the major system acquisition process. The cycle portrayed in Figure 1 is available in many other forms, and this acquisition cycle is the basis for most related-subject models. The systems approach model provided views the entire procurement process. By defining appropriate systems and system components the model can, theoretically, be varied to portray the functional relationships applicable to major Class V modification programs. The chain-of-events models tend to view the process as if the procurement process is understood, and deal primarily with the procedures following the selection of the modification method as the (preferred) alternative solution to the statement of need. The program flow models return to the overview of the acquisition cycle, but interject the specific steps required for the modification acquisition process (as in Figure 8).

The type of model developed and the type of model required both relate to the position of the developer and the end use of the model. The systems approach model as developed by Sapp was part of a doctoral dissertation and appears to the layman as being

very academic. However, because of education and data programming and processing advances, the use of a systems approach appears feasible for today's problem-solving and decision-making. Unfortunately, mathematical computer models are often difficult to visualize, dependent on good input and variable choice, and inflexible when management intuition is perceived as providing the best choices or reactions.

The model developed by AFLC/LOA was prepared by managers familiar with the subject and able to interpret it clearly and concisely for use as a teaching tool. However, because of the simplification and directness required for this model, any understanding of the complexities of the programs and the formal guidance is omitted. For this reason, this particular model would be inappropriate for anything but an introduction to the procedures for the modification program manager. The complexities are better illustrated by the Haslam and Berger model and their accompanying descriptive narrative; but the Haslam and Berger model might be too complicated for a beginner's overview, and too simple for the experienced manager.

The AFALD models provide the most simplified picture of the models presented here: visualizing the program flow as requirement-development-implementation, but warning even the novice immediately of the diversity and

complexity by providing four basic models. The pamphlet then supplies a narrative that should be valuable to both the beginner and the active manager--a thorough description of the process, complete with organization names, symbols, acronyms, responsibilities, output, relation to the new system acquisition process, and applicable directives. Possible deviations are noted. This resource was written by research-ers, with inputs by managers, for managers.

This chapter has presented examples of three types of Class V modification management process models that exist in studies and formal guidance. These are the systems approach, the chain-of-events model, and the program flow model. The developer and his purpose were evaluated when reviewing these examples. Potential users should carefully determine the specific need when adapting or applying these or similar models for individual use.

The need for a model of the management process for major Class V modification programs was just one of the issues suggested in earlier studies. This need has been fulfilled. Other issues were addressed in this study by interviewing experienced managers of Class V modification programs. An analysis of their responses is in the following chapter.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF MANAGERIAL OPINIONS

The first two research objectives, to review and summarize current studies and formal guidance regarding Class V modification management, and to identify and compare existing models developed to describe the Class V modification management process, have been addressed. An annotated bibliography is provided as Appendix D, and descriptive models are discussed in Chapter III.

In order to address the third research objective: To discover what issues or problems are outstanding and considered important to managers involved in the Class V modification management process of major systems, twelve managers having responsibility for the five programs meeting the DODD 5000.1 criteria were interviewed. The organizational addresses and job titles of the personnel contacted are identified in Appendix B. The interviews were structured, but informal. The researchers asked for reactions to statements developed from issues or problems described as important or controversial in prior studies. In every case the manager was invited to explain or support his responses with examples and personal insights.

The specific analysis of the interview results presented in this chapter is grouped according to the following topics: experience of the respondents; adequacy of regulations, directives and guidance; management authority, responsibility and effectiveness; understanding the modification management process; funding constraints; attitudes concerning Class V modifications versus new system acquisition; and previously identified problem areas. A general summary of the interviews follows, accompanied by a discussion of corollary findings.

Analysis of Interviews

Experience of Respondents

In order to understand the spectrum of responses and information sought and obtained in the personal interviews, it was necessary to verify the credentials of each respondent. This was accomplished through the use of the first four questions that appear in the Interview Guide (Appendix C) which have a demographic orientation. Answers to these questions validated the respondents as being credible sources capable of providing insights into the management of major Class V modifications. As an added benefit, the answers presented an experiential profile of those managers selected for participation in the study.

The respondents contacted had completed between ten years and nine months and thirty years of federal service (including both military and civilian time) with the average length of service being twenty years and three months. The duration of their current assignment to the particular Class V modification program of interest ranged from a minimum of only one year to a maximum of six years and two months. Each respondent had served in his present position for an average of two years and four months.

Only 42 percent of those managers contacted had any previous experience in managing other Class V modification acquisitions. Of that number, the length of prior experience was as low as two years to as high as ten years for an average of four years and seven months. The balance of the respondents could claim only their current assignments as their extent of involvement with Class V modifications. This latter fact should not be construed as a hindrance to effective performance, however, since it was the opinion of several managers that having a single type of background (i.e., only new systems or only modifications) would be a mistake. Thus, the prospect of a Class V modification specialist having any advantage over someone with solely a new systems acquisition background did not receive support.

Table 3 displays the range of responses received on a statement-by-statement basis for the remainder of the

TABLE 3

NUMERICAL RESULTS OF THE
STRUCTURED INTERVIEWS

1 = Strongly Disagree
2 = Disagree
3 = Neither Disagree or Agree
4 = Agree
5 = Strongly Agree

	Response				
Statement No.	1	2	3	4	5
5	1		2	5	4
6	2	1	2	5	2
7	1	1		4	6
8	2	3	2	3	2
9*	2	2	1	4	2
10	1	3	2	5	1
11	2	2	3		5
12	5	5	2		
13	4	4	2	2	
14	1	2	1	6	2
15	1	1	6	2	2
16A	2	3	1	3	3
16B	2	3	1	3	3
16C	1	3	3	3	2
17A		1	3	7	1
17B		1	3	5	3
17C		2	2	6	2
18	4	5	2		1
19	7	3	2		
20	1	1	2	5	3

*NOTE: Only eleven responses were received on Statement 9.

structured interviews, and continued reference to it will aid in understanding the subsequent analysis and discussion.

Adequacy of Regulations, Directives, and Guidance

Statements 6, 7, 10 and 15 are related to an assessment of the adequacy of regulations, directives, and guidance that pertain to Class V modifications.

Fifty-eight percent of the respondents agreed that there is a clearly defined Class V modification process (Statement 6) as compared to 25 percent who disagreed with the statement. Of those who agreed, however, the stipulation was made that the process was typically not followed to the letter of the regulation nor used as designed. These qualifiers left the impression that the dynamics of the individual programs mandate the use of accepted deviations to make the process adaptive as necessary. Of those who responded negatively, the comment was made that although a modification process exists, it is separate and distinct from the acquisition process.

Eighty-three percent of those interviewed agreed that their respective programs were correctly identified as Class V modifications in accordance with the definition and criteria set forth in Air Force Regulation (AFR) 57-4 (Statement 7). What is worthy of note was the view

of those who answered negatively that sometimes the categorization of a program as a Class V modification is merely a consequence of not being able to identify it as fitting one of the three subcategories (A, B, or C) of Class IV modifications. This situation was explained as being analogous to a waterfall effect whereby a requirement for a changed capability (Class IV) "falls through" to become a new capability (Class V) only as a last choice. Conversely, every effort is made to categorize the proposed new capability modification as something other than Class V because of problems in obtaining the funding for those modifications ultimately designated as Class V. This funding complication is more fully addressed in the analysis of Statement 11.

Fifty percent of the respondents agreed with the adequacy of written guidance or direction available to manage their programs (Statement 10), while 33 percent disagreed. The presence of pertinent DOD, USAF, command-unique, or joint command policies and regulations was not seen as presenting a problem. What was often lacking, in terms of both timeliness and clarity of intent, however, was the implementing Program Management Directive (PMD). The managers expressed their concern on the use of abbreviated telegraphic messages as direction to proceed in lieu of more comprehensive and formal PMDs. It was not uncommon for many months to pass between the

receipt of a message and the formal follow-up to occur. This situation was viewed by the managers as allowing an opportunity for after-the-fact ratification of decisions, rather than providing helpful guidance in advance of those decisions.

A neutral position was expressed by 50 percent of the managers concerning the advantage of aggregating several smaller dollar value Class V modifications into one major program (Statement 15). Air Force policy and procedures specify the assignment of a discrete identifying number to each Class V modification and the management of each one in accordance with its own PMD. Whichever major command (MAJCOM) has primary management responsibility for that particular modification number directs the effort. Thus, it is not unusual for AFSC and AFLC, or two or more organizations within a MAJCOM, to be directing individual modifications to the same weapon system at essentially the same time. On the physically extensive, high-dollar value B-52 OAS and CMI modification programs, management direction of separate modification numbers for program visibility and tracking purposes was the reason given even though both programs overlap to a great degree. Those managers voicing agreement with the statement as to the advantages of program aggregation cautioned that this

approach would be practical only if the several modifications planned were closely related (e.g., two avionics modifications).

Management Authority, Responsibility, and Effectiveness

Statements 8, 12, 13, 18, and 19 were designed to obtain inputs assessing managerial authority, responsibility, and effectiveness in managing major Class V modifications.

Statement 8 posed the idea of the existence of one central Air Staff organization functioning as a coordinator of AFSC and AFLC modification activity. A balanced response was achieved with equal 42 percent proportions of managers either agreeing or disagreeing, the remainder being noncommittal. Of those agreeing, opinions differed as to whether Research and Development (USAF/RD) or Logistics Engineering (USAF/LE) would be considered the one focal point. Further, those agreeing conditioned their responses by differentiating between PMD direction and funding focal points. Those respondents answering negatively expressed the comment that the Air Staff was not designed around the single management concept. As such, focal activity would shift from office to office within the Air Staff as the modification proposal analysis (MPA) alternative developed into an authorized, ongoing program.

Eighty-three percent of the managers polled either disagreed or strongly disagreed with the statement that Class V modification hardware development and implementation were independently manageable, separate and distinct activities (Statement 12). The exceptionally strong negative response underscores the central issue in Balven's study (3), namely that these two activities should not be viewed by management as the wording of the statement would suggest, although they often are. Situations where this is most likely to occur are those programs where management responsibility is split between AFSC (development) and AFLC (implementation).

Faulty communication and coordination exchanges between the commands cause problems that can adversely affect the successful fielding and future supportability of the modified system. This potential problem was addressed early in the lifetime of both the B-52 OAS/CMI and the C-141 Stretch modification programs. In the former, two Deputy Program Managers have been assigned: one is for Acquisition and one is for Logistics. These managers are physically located in the System Manager's (SM) organization at Oklahoma City Air Logistics Center (ALC) and the Program Manager's (PM) organization at Aeronautical Systems Division (ASD), respectively. In this way, possible intercommand misunderstandings and conflicts can be dealt with by the on-site presence of managers with

authority representing the other command's viewpoint, regardless of the location. This emphasis on a close working relationship is further enhanced by the existence of a Memorandum of Agreement (MOA) that delineates the responsibilities of each command and those which cross commands.

In the case of the C-141 Stretch program, primary responsibility for both development and implementation was directed to AFLC, which is an exception to the general rule of development being a function handled by AFSC. Using a Mini-System Program Office adaptation of the project management concept, the C-141 program managed by Warner Robins ALC has effected a significant role change by drawing on internal engineering expertise for both design and integration of the system. The traditional assumption that AFLC lacks design engineering capability precluded these dual responsibilities from being assigned to AFLC more frequently in the past.

For Statement 13, dealing with the existence of one line of authority and responsibility across commands, 66 percent of the respondents answered in the negative. This statement parallels number 12 and is related to number 8 as well. Given the perception that development and implementation activities should not be separated from a functional standpoint, but knowing that organizationally AFSC and AFLC are split along these responsibility lines,

the responses to Statement 13 are not surprising. Unless one of the two commands has been given the authority and responsibility to transcend the traditional functional and organizational boundaries separating the two, no one is tasked to perform an overall coordination function. Referring again to the analysis of Statement 8, no clear consensus could be determined as to what element within the Air Staff functions as a modification coordinator or whether one even exists for Class V modifications.

Response to the query concerning over-participation by the Air Staff in the management of the respondent's program (Statement 18) demonstrated 75 percent in disagreement and only 8 percent agreeing. Most of the respondents did not object to the Program Element Monitor (PEM) involvement with program management--provided key decision-making remained within the organization charged with the responsibility for completing the modification. The Air Staff was viewed as being part of the modification management team, and their participation was invited rather than avoided.

A similar but reworded inquiry was made relative to under-participation on the part of the using command designated to operate the modified system (Statement 19). Disagreement was evidenced by 83 percent of the managers with no one answering affirmatively. Overall program successes were attributed, in part, to enthusiastic support

by the user in advocating the continued need for and utility of the modified system as the means of satisfying the mission requirement. The user command was considered as an essential partner in providing the necessary inputs from an operational perspective to balance the business orientation of the acquisition commands.

Understanding the Modification Management Process

Statement 16 was separated into three parts, each one corresponding to the degree of understanding of the Class V process at the line organization in the field or "working level" (Part A), the staff organizations at the major command headquarters level (Part B), and the staff organizations at the Air Staff level (Part C). Responses to Parts A and B were identical and showed slightly greater agreement (50 percent) than disagreement (42 percent) with the idea that full understanding is lacking at both the field and MAJCOM levels. The respondents were quite candid in attributing this situation to themselves as well as to other levels, and felt that less than adequate familiarity was a consequence of the need to accomplish the process rather than to take the time to formally learn the process. The perception was that what was required to do the job could be picked up on the job.

Part C, dealing with the understanding by the Air Staff was even less definitive with only 42 percent expressing agreement versus 33 percent indicating disagreement. Those managers volunteering clarification on this point felt that the Air Staff was one or more levels away from where the day-to-day management issues and decisions were being made.

Funding Constraints

Statement 11, concerning planning, programming, and budgeting for funding imposing peculiar managerial constraints on Class V modifications, was intentionally set aside for special attention. Both the Cilvik and Balven studies pointed out recurring basic problems in this area.

Although 33 percent of the managers disagreed with the statement, 42 percent strongly agreed. Extremely held views, pro or con, were encountered on this issue with the opinions tending to follow a staff and line dichotomy, respectively.

Class V modifications for aircraft are funded from two resource pools. Hardware monies for Group A or B kits are funded from the procurement appropriation (3010) pool, or more specifically, budget program (BP) 1100, which have an obligation authority of up to three years. Monies to install hardware kits, however, come from the operations and maintenance (O&M 3400) pool which must be obligated

within one year. This requirement presents the problem of assuring that the installation work schedules are closely monitored. Failure to have installation work in progress may mean the loss of O&M funds at the end of the fiscal year in which such funds were authorized.

In addition to the complication of time-constrained funding from dual resource pools, funding of the BP 1100 monies is handled on a line item basis since Class V modifications are individually identified and managed. Thus, if two or more Class V modifications to the same weapon system are being processed concurrently, underestimating the cost of one cannot be offset by freeing monies from the other without lengthy reprogramming authority approval. Serious and costly program delays may result due to the lack of funding flexibility.

These peculiarities are not present for new system production programs that are funded from one pool of monies for both hardware acquisition and installation (i.e., BP 1000). According to several of the managers, utilization of BP 1000 monies for modifications as well as new production, or utilization of BP 1100 monies for both hardware and installation would eliminate the present funding problem.

Attitudes Concerning Class V Modifications Versus New System Acquisition

Statements 5, 9, 14, and 20 were all designed to compare the managers' attitudes regarding the application of the Class V modification process to existing weapon systems in contrast to acquiring new systems.

Seventy-five percent of the managers agreed that Class V modifications can provide an operational capability equal in effectiveness to that provided by a new system (Statement 5). This finding is predicated upon an assumed faster program completion time through the modification process to achieve operational readiness than the time required by the new system development cycle. One manager conditioned his affirmative response solely to the added capabiity provided by modifications, but not to the effectiveness of the total weapon system, stating that the two were too dissimilar for comparison purposes.

Agreement with the idea of the rapid growth in the use of the Class V process without a commensurate growth in the related management techniques as a contributing factor to the problems encountered with the process was reached by only 55 percent of the respondents; 36 percent disagreed (Statement 9). No definitive examples were provided, perhaps because of the general satisfaction with current procedures.

Sixty-six percent agreement was obtained with the statement that Class V modifications present unique management problems compared to new system acquisitions (Statement 14). Two primary examples were offered. First was the funding peculiarity aspect already discussed under Statement 11. Second, and related, was the level of detail required in the modification proposal analysis (MPA) forms. This documentation was cited as having to be much more precise and harder to understand than the equivalent type of information required to support a new system proposal. Of the remaining respondents, 25 percent disagreed, being unable to attribute any unique difficulties to programs designated as Class V.

Sixty-six percent of the managers expressed agreement with Statement 20 concerning future opportunities for managing other Class V programs. Although noting frustration at times, several respondents indicated both satisfaction and fascination with the process. Only one manager strongly disagreed, citing an attitude of indifference from higher headquarters to "just another modification program," notwithstanding the hundreds of millions of dollars involved.

Previously Identified Problem Areas

Statement 17 was formulated to test the applicability of three major problems described in Balven's study

(3) of the overall environment surrounding Class V modifications to the four weapon systems that involve modifications which meet the definition of major systems acquisitions.

First, Part A sought positions concerning system and subsystem integration as being a problem. Second, Part B attempted to associate problems with management approaches. Finally, Part C addressed concurrent hardware development and production. In each instance, agreement was indicated by 66 percent of the managers. Differences in the degree of agreement varied within each part as shown in Table 3. No attempt was made to rank responses concerning these previously identified problems.

Note that of the three parts, management approaches received the highest number of strong agreement responses. Differences in program and project management versus system and item management orientations followed by AFSC and AFLC, respectively, were highlighted. Also mentioned was the extent of multiple, independent modification actions affecting a weapon system as a whole being fragmented into individual modification programs (some Class IV and some Class V) and being assigned to several organizations for accomplishment.

As mentioned earlier, both system and subsystem integration and concurrency were felt to be equally important areas for potential problems in modification

acquisitions. The two were cited as being interrelated on the basis that problems arising in the former are frequently the result of problems developing as a direct consequence of the latter.

Summary of the Interviews

According to the tabulated results shown in Table 3, there appears to be no actual problems with the general concept of the Class V modification process, or the regulations and guidance that support it. What may be a potential problem, however, is the content and timeliness of specific implementing program direction.

Both vertical and horizontal flows of authority and responsibility through and across the chain of command were viewed to be continually important areas of management concern. Participation by outside organizations was solicited, as long as it did not upset the existing authority and responsiblity balance.

Current understanding of the Class V modification process was considered sufficient to do the job by all levels of management, but with some need for improvement evident.

The mere mention of the term "Class V modification" evoked the response that the term was synonymous with funding problems. This finding was attributed to the requirement for obtaining monies from two different

appropriations sources which could be counterproductive to a program's success.

The managers displayed a healthy attitude and open mind toward the use of the Class V modification process as an alternative strategy to new system acquisition.

Finally, three specific problems identified in prior studies were seen to appear in major modifications just as frequently as in less-than-major modifications by the majority of the managers.

Except where noted, very few black or white conclusions may be drawn solely on the basis of the numerical responses received. It is necessary for the reader to interpret the examples reinforcing the respondents' individual positions that have already been provided in addition to those that form the nucleus of the next section.

Corollary Findings

By allowing the respondents the opportunity to elaborate on any of the structured statements or to convey opinions on topics that had not been addressed, several corollary issues and problems came to the attention of the researchers that warrant further discussion. These are presented as they occurred without regard to priority.

-- AFSC managers view major programs in such a way that the main differentiator is the dollar value of the program, first; the fact that the program may be a modification is secondary. AFLC managers, on the other hand, view a program as a modification that happens to meet the major program definition criteria.

-- Managers feel it is difficult to know exactly where one modification program ends and another begins. This is true within Class V modifications as well as between Class Vs and Class IVs. The difficulty is because of the amount of overlap that occurs when the inclusion or non-inclusion of a prior modification has an effect on the planning and ultimate success of the present modification. A further complication to this point is the number of different organizations that can become involved when system management responsibility is diffused, making the overall system's management difficult.

-- Major Class V modifications, such as those identified in this study, involve the actual remanufacturing of extensive portions of the weapon systems being modified which tends to require the use of contractor personnel for both design and installation effort. As such, these programs are beyond the depot level capability and capacity which normally utilize Air Force personnel for installation of the less complex, smaller dollar value modifications.

-- Configuration identification and control is a critical consideration in forecasting the total cost of the modification program from both financial and contractual viewpoints. It would be reasonable to assume that no two model series aircraft undergoing the same modification are likely to be the exact same configuration, thus causing complex estimating problems for both the government and the contractors involved.

-- Knowing that contractors perform the installation on major Class V modifications, and that installation is funded using one-year O&M monies, the contractors are impacted by time limitations due to the potential expiration of available funding.

-- Input schedules of the airframes to be modified are sensitive to the contractors' installation and delivery schedules. Problems with the output schedules ripple back to the input schedules, often requiring the rescheduling or reidentification of specific airframes to be input, thus creating potential readiness problems.

-- The concurrent development and production of hardware also impacts the development of any related software. Normally, the software development would follow sequentially after hardware development. Under a concurrent program one of two problems can occur: the value of the software may be suspect due to the instability of

the hardware design; the software may not be ready until long after it would have been optimally useful.

Having addressed the third research objective of discovering what issues or problems are outstanding and considered important to the managers of major Class V modifications, the research project's overall summary and conclusions are presented in the final chapter.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter contains a summary of the process followed in addressing the three Research Questions presented in Chapter I. Also, a summary of the conclusions reached, based on the research findings, is presented in this Chapter.

Summary

Research Question One

What research and direction is available regarding Class V modification management?

In an effort to develop a current annotated bibliography of studies and guidance regarding Class V modification management, the researchers reviewed three types of resources: books and periodicals; studies, theses, and staff projects; and formal guidance. A comprehensive collection of these publications which regulate, direct, or guide the modification manager, and studies which are referred to frequently, are recent and timely, or contribute to the study of this topic with methodology or background information, were provided as Appendix D of this thesis.

Research Question Two

What basic descriptive Class V modification management process models exist, and how may they be used?

The models reviewed were found in the studies and formal guidance collected to answer Research Question One. Four modification management process models representative of three distinct model types were identified and compared in Chapter III. The systems approach was illustrated by the complex mathematical model developed by Richard S. Sapp to describe the procurement process in general and to evaluate and analyze cost outcomes in particular. Two chain-of-events models were illustrated. The AFLC/LOA stairstep picture and accompanying narrative provided an overview of AFLC's involvement in the Class V modification management process. D. E. Haslam and C. C. Berger's model was included to show how a similar diagram can provide more complex interface information. Finally, AFALD's program flow model started with the simple three-phase process--requirement, development, implementation--illustrated likely variations, and showed how to enhance the basic flow model with specific activities.

Research Question Three

What issues or problems are outstanding and considered important to managers involved in the Class V modification management process of major systems?

Knowledge of the literature and models describing the Class V modification process only presents a partial picture of it since these do not necessarily include the opinions of the managers charged with using the process. To provide those opinions on problems and issues that currently confront the managers of modifications to major systems, semistructured interviews were conducted using the Interview Guide provided in Appendix C. The managers' inputs were analyzed and discussed in Chapter IV, with mixed results that support some previously documented problems and refute others. Specific examples and corollary findings were also provided for clarification and information.

Conclusions

-- Adequate formal guidance, regulations, and directives are available for Class V modification management. There have also been several informative study projects regarding Class V modification and the management process. The managers interviewed were aware of the formal guidance, even that affecting other functions, and were often familiar with one or more of the studies. Experienced managers claimed, however, that few, if any, major Class V modification programs followed the specific standards. Therefore, frequent reference to directives was not made. Because of the magnitude, visibility, and

political impact of these programs, however, it would be beneficial for the modification manager to: (1) search DLSIE and DDC regularly for projects related to modification management or a specific program; (2) take time to read current trade- and military-oriented periodicals; and (3) frequently review, and evaluate the application of the related formal guidance.

-- Another conclusion, related to the one above, is that there are several alternate models of the modification management process--and for Class V modifications in particular--available, and useable. Review of the model types, and utilization of one or more, would help the manager visualize how a specific program follows or varies from the standard suggested by the regulations. The mathematical models and the support they and data processing provide are important, and becoming increasingly vital. However, their use involves study and experimentation, often by a systems-oriented specialist. Most managers could benefit more readily by using a diagrammed model to illustrate or track the chain-of-events or program flow. In any case, the manager should evaluate the developer and his purpose, as well as the manager's own personal needs, choose the most appropriate model-type, and adapt it to a specific program.

-- The effectiveness and appreciation of management authority and responsibility for major modification

programs is more a function of politics and personalities than standards set by regulations. Managers were more comfortable with the competency of other organizations and the intercommand interfaces if the program was guided by a comprehensive Program Management Directive. This is seen as a result of the lack of a single authority figure, starting at the Air Staff level.

-- The general area of funding is the most troublesome issue to the modification managers. The problem of initial funding for a major Class V modification, as well as the difficulties surrounding single-year funding of multi-year projects, encourages erroneous modification categorization and management's use of gamesmanship tactics.

-- Major modifications are viewed differently between the two major acquisition commands. AFSC takes the position that the dollar value threshold differentiating major programs from less-than-major programs determines the management direction to be followed. The fact that a major program is also a Class V modification program is of less importance. This view results from the fact that AFSC performs relatively few Class V modifications, compared to AFLC, and rarely any after PMRT. Because AFSC is design-oriented prior to PMRT, the modification management experience base which generally develops through supporting a weapon system over its lifetime is

limited. For this reason, problems arising during the program approval and funding cycles are assumed to require significant deviations to the regulations governing the modification process.

AFLC, which manages the majority of Class V modifications, sees a modification for what it is: An opportunity to improve upon an existing weapon system by making configuration additions or deletions to suit changed operational requirements. The dollar value implication does not receive primary emphasis. Rather, this emphasis is reserved for the technical aspects of the program relative to whether or not extensive design effort will be required. Overly pessimistic assessments in this area, and the assumption of limited design engineering capability within AFLC, has led to a virtual automatic assignment of this responsibility to AFSC. Based on AFLC's experience with the C-141 stretch program, this may not be necessary.

-- Many of the concerns voiced by managers related to the splitting of duties and responsibilities between the two major acquisition commands. Although the breadth of these programs requires consideration of management techniques on a case-by-case basis, the PMRT usually symbolizes a significant change in the support concept. This is related to the preceding conclusion--the difference in major command attitudes and emphasis. For most major

Class V modifications a single "weapon system manager" should be assigned continuous responsibility throughout the management process. For those systems already managed by AFLC, the existing system management office is the logical choice for the assignment of that responsibility. AFSC engineering support would still be important, even vital. For changes that involve new hardware engineering, not interpreted as modifications, AFSC would have primary responsibiity with AFLC support for logistics. The requirement for a single manager responsibility, and enhanced intercommand support, should be interpreted as the outstanding issue in the Class V modification process.

With the completion of this project, and others that were cited herein, there no longer exists a requirement for further generalized study of the Class V modification management process. However, specific issues and problems reaffirmed or introduced in this thesis require further study and resolution.

APPENDIXES

APPENDIX A

GLOSSARY OF TERMS

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AN ACQUISITION ALTERNATIVE: SYSTEM MODIFICATION TO SATISFY MISS--ETC(U)
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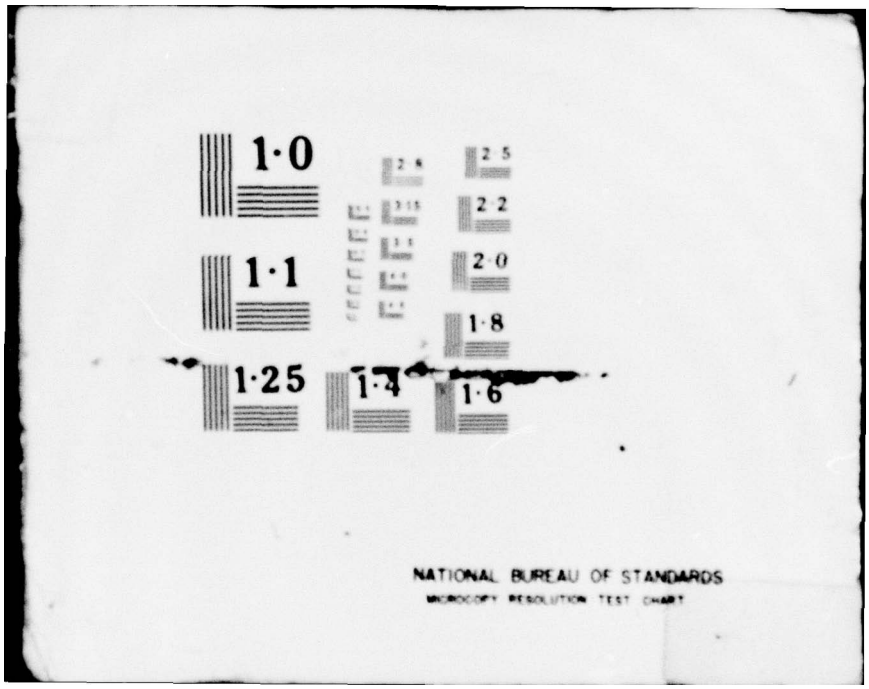
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NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

Acquisition Life Cycle. Normally, this consists of five phases (conceptual, demonstration and validation, full-scale engineering development, production, and deployment phases) with each of the first four preceeded by milestone decisions (program initiation, demonstration validation, full-scale engineering development, and production and deployment decisions). A program may skip a phase or have program elements in any or all phases (AFR 57-1).

Bugetary Cost Information (BCI). Preliminary cost data provided to HQ USAF to assist in the evaluation of the requirement and the development of the Class V modification program (AFR 57-4).

Class V Modification. A modification to provide a new or improved operational capability and is required to accomplish any assigned mission that cannot be accomplished with the present configuration (AFR 57-4).

Classes of Modification. Descriptive breakout of modifications into five classes by rules and approving authority (AFR 57-4).

Configuration Change. Alteration of the form, fit or function of a Configuration Item which changes its physical or functional characteristics (AFR 57-4).

Configuration (Change) Control Board (CCB). A board composed of representatives from program/project functional areas such as engineering, configuration management, procurement, production, test and logistic support, training activities, and using/supporting organizations. This board approves or disapproves proposed change requests, including every Class IV and Class V modification. In AFLC the chairperson is a representative of Material Management/Logistics Operation; in AFSC the program/project manager is normally the board chairperson (AFR 65-3).

Configuration Item (CI). An aggregation of hardware or software, or any of its discrete portions, that satisfies an end use function and is designated by the government for configuration management. Configuration Items (CIs) may vary widely in complexity, size, and type from an aircraft or electronic system to a test meter or round of ammunition. During

development and manufacture of the initial (prototype) production, CIs are those specification items whose function and performance parameters must be defined (specified) and controlled to achieve the overall end use function and performance. During the operational and maintenance period, any reparable (non-expendable) item designated for separate procurement is a configuration item. In AFR 57-4, "CI" and the terms "system, equipment, conventional munition, or computer program" are synonymous (AFR 65-3).

Defense System Acquisition Review Council (DSARC). An advisory body to the Secretary of Defense on major system acquisitions. The council members are the Office of the Secretary of Defense (OSD) principals (DODD 5000.1).

Deputy Program Manager for Logistics (DPML). The logistics representative for major programs at the Program Office. The DPML is directly responsible to the PM for all logistics tasks and ensures that logistics participation and support capabilities agree with program objectives and that logistics support requirements are reflected in the system design (AFSCP 800-3).

Financial Management. The process of determining requirements, obtaining resources, and judiciously applying assets to accomplish predetermined objectives within available resources (AFM 172-1).

Five Year Defense Program (FYDP). The official program which summarizes the Secretary of Defense approved plans and programs for the Department of Defense. The FYDP is published at least once annually. The FYDP is also represented by a computer data base which is updated regularly to reflect decisions (AFP 172-4).

General Operational Requirement (GOR). A formal serially-numbered document giving a general description of operational capabilities deemed necessary at a specific time, outlining the capability desired rather than the means of accomplishment, describing the objective, operational concept, expected operational environment and other pertinent factors to be considered (AFR 400-3).

Group A Kit. The items, parts, or components to be permanently or semipermanently installed in a

configuration item to support, secure, interconnect, or accommodate the equipment provided in the modification Group B Kit (AFR 57-4).

Group B Kit. The equipment which, when installed in a configuration item with a Group A Kit, completes a modification. Normally, Group B items are removable (AFR 57-4).

Item Manager (IM). The AFLC Air Logistics Center (ALC) (or other service or agency) assigned the management responsibility for commodity-type items by Federal Supply Class (AFSCP 800-7).

Integrated Logistics Support (ILS). A process that identifies the organic Air Force functions required to support operation and maintenance in a timely, systematic, and orderly manner. The process requires continual analysis of design to determine logistics impact and to select those that minimize logistics support burdens on the operating and supporting commands, and to make certain that logistics support is available at the operating location upon delivery of the system or equipment for use (AFSCP 800-3).

Logistics Support. The supply and maintenance of material essential to proper operation of a system in the force (DODD 5000.1).

Major System. That combination of elements that will function together to produce the capabilities required to fulfill a mission need. Major system acquisition programs are those programs that: (1) are directed at and critical to fulfilling an agency mission, (2) entail the allocation of relatively large resources, and (3) warrant special management attention (OMB Circular A-109). System programs involving an anticipated cost of $75 million in research, development, test and evaluation (RDT&E) or $300 million in production will be considered for designation as a major system acquisition within DOD (DODD 5000.1).

Mission Need. A required capability within an agency's overall purpose, including cost and schedule considerations (OMB Circular A-109).

Modification. A configuration change to a produced configuration item. Modifications may be classified as updating changes or according to criteria in Table 2, AFR 57-4, and are applicable to any configuration item (AFR 57-4).

Modification Program Management Plan (MPMP). The Modification Proposal and Analysis and documentation to supplement it on high risk or high cost modifications (AFR 57-4).

Modification Proposal and Analysis (MPA). A comprehensive technical study and cost and schedule analysis that considers all aspects of a proposed Class V modification (AFR 57-4).

Modification Review Group (MRG). This group uses the Priority List to construct the Class V modification program and budget, which becomes the proposed BP1100 program and budget, submitted to the PPBS cycle. It is chaired by the Directorate of Logistics Plans and Programs (USAF/LEX). The primary purpose of the MRG is to insure that the modification is ready to be implemented so production funds can be obligated in a timely manner (AFLC/AFSCP 800-34).

Planning, Programming, and Budgeting System (PPBS). An integrated system for the establishment, maintenance, and revision of the FYDP and the DOD budget. Through this system, an attempt is made to combine policy information with budgetary allocation and to provide a mechanism for analysis (AFP 172-4). A PPBS action includes that activity needed to obtain the resources necessary to satisfy a validated and operational need, including appropriate resource program through HQ USAF, the Office of the Secretary of Defense, and the Congress. PPBS actions should begin about twenty-two months before the executive fiscal year begins (AFR 57-1).

Priority Review Group (PRG). This group meets twice yearly, in January, to make an input to the POM exercises, and in August to make an input to the AF budget submission. It is composed of and chaired by individuals who represent the various functional divisions of the Directorate of Operations and Readiness (USAF/XOO). When the PRG meets, it is briefed on each modification which is projected to start during the FYDP period being considered (AFLC/AFSCP 800-34).

Program Element (PE). A description of a mission by the identification of the organizational entities and resources needed to perform the assigned mission. Resources consist of forces, manpower, material quantities, and costs, as applicable. The program element is the basic building block of the FYDP (AFP 172-4).

Program Element Monitor (PEM). The PEM is responsible for advocating the program and competing for funds. For the majority of aircraft subsystems the PEM will be in the Directorate of Development and Acquisition (USAF/RDP), although may also be in the Directorate of Reconnaissance and Electronic Warfare (USAF/RDR) or Directorate of Space (USAF/RDS) (AFLC/AFSCP 800-34).

Program Management Directive (PMD). The official HQ USAF management directive that directs the implementing and participating commands and satisfies documentation requirements. It is used during the entire acquisition life cycle to state requirements and request studies, as well as initiate, approve, transfer, modify, or terminate programs. The content of the PMD, including the required HQ USAF review and approval actions, is tailored to the needs of each program (AFR 800-2).

Program Manager (PM). The single Air Force manager (system program director, program/project manager, or system/item manager) during any specific phase of the acquisition life cycle (AFR 800-2).

Program Objective Memorandum (POM). A memorandum in prescribed format submitted to the Secretary of Defense by the Secretary of a Military Department or Director of a Defense Agency which recommends the total resource requirements within the parameters of the published Secretary of Defense fiscal guidance (AFP 172-4).

Requirements Review Group (RRG). A HQ USAF general officer review board which reviews, evaluates, and recommends proposals for new or improved operational capabilities. The group will review and recommend operational need validity before commitment of significant resources to solution programs and will review solution programs at key decision points to evaluate program success and recommend follow-on program activity (AFR 57-1).

Retrofit (Retroactive Fit). A modification of a configuration item to incorporate changes made in later production items (AFR 57-4).

Statement of Operational Need (SON). (Formerly GOR). A formal numbered document used to identify an operational deficiency and state the need for a new or improved capability for USAF forces. It provides the basic justification to initiate major and nonmajor systems acquisition or modification proposals (AFR 57-1).

System Manager (SM). The AFLC ALC with management responsibility for selected systems (AFR 57-4).

System Program Office (SPO). The office of the PM and the single point of contact with industry, government agencies, and other activities participating in the system acquisition process. It is the office the PM sets up for the acquisition of system, subsystems, equipment, munitions, or modifications to them (AFR 800-2).

Time Compliance Technical Order (TCTO). Documents prepared in accordance with MIL-T-38804 (USAF) for use in accomplishing and providing a record of any one-time inspection (with or without replacement or installation of components) or in accomplishing and recording a retrofit change or alteration to the design or construction of a CI or its associated support equipment (AFSCP 800-7).

Weapon System. A weapon and those components required for its operation. It is a composite of equipments, skills and techniques that form an instrument of combat which, usually, but not necessarily, has an aerospace vehicle as its major operational element. The complete weapon system includes all related facilities, equipment, material, services, and personnel required solely for the operation of the aerospace vehicle, or other major element of the system, so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment (AFR 400-3).

APPENDIX B

MAJOR CLASS V MODIFICATIONS--
PROGRAM AND PERSONNEL DATA

Program Summaries

C-141A(B) Stretch/Aerial Refueling

Class V Modification Number 2875 involves the addition of new center fuselage sections fore and aft of the wing, which will add 23.3 feet to the aircraft's overall length of 145 feet. This modification will provide 233 square feet of new floor space, and over 2,100 cubic feet of added volume, which represents an increase of over 33 percent to the existing cargo carrying capacity. Aerial refueling capability is being incorporated in conjunction with the structural changes to extend the aircraft's operational range beyond its present limitation of 3,860 nautical miles. This modification will eliminate the necessity of landing on foreign bases to refuel, thereby adding flexibility to the plane's mission profile (8:41-42).

The modification is managed by Warner Robins ALC with work being accomplished by Lockheed Georgia at its Marietta facility. Current plans call for modifying the entire C-141A fleet of 271 aircraft by 1982, which will result in a new B-series model designation. Estimated cost of the program is approximately $500 million.

F-4E(G) "Wild Weasel"

Class V Modification Number 2740 involves the removal of the 20 millimeter cannon on the McDonnell-Douglas F-4E and replacing it with the APR-38 radar homing and warning system. The system is designed to locate and destroy enemy surface-to-air missile sites.

The modification is managed by Ogden ALC, with the work being accomplished by Air Force personnel as a part of programmed depot maintenance. One hundred and sixteen aircraft will be reconfigured, resulting in a G-series model designation. Estimated cost of the program is approximately $325 million.

EF-111A Tactical Jamming System (TJS)

Class V Modification Number 3015 involves the addition of about 3,000 pounds of sophisticated Electronic Countermeasures (ECM) avionics transmitter and receiver subsystems, such as the ALQ-99E Blanking Unit, to redesigned weapons bay and tail pod locations on the General Dynamics (G-D) F-111A. This modification will include extensive redesign of the cockpit and strengthening of the vertical tail fin. These changes will permit adaptive, tactical ECM missions in any of three different modes: barrier/standoff; close air support; or penetration/escort.

The modification is managed by Aeronautical Systems Division's EF-111A TJS Program Office (SPO) with the work being accomplished by the Grumman Corporation at its Bethpage and Calverton, New York, facilities. Plans call for modifying forty-two G-D F-111A aircraft through 1982 which will result in the EF-model designation. Estimated cost of the research and development and production programs is approximately $1 billion.

B-52 G/H Offensive Avionics System (OAS)

Class V Modification Number 3023 involves the addition of a package of new avionics sensors, receivers, and transmitters which will include the ASN-131 Standard Precision Navigation System, Doppler radar, radar altimeter, and attitude and heading reference system. This package is the first phase of improvements to the B-52G and H models' offensive operability, and will greatly improve the subsystems' reliability and maintainability as well.

The modification is managed by ASD's Strategic Systems Program Office with the work being accomplished by Boeing at its Wichita facility. For planning purposes, a total of 269 B-52Gs and Hs will be modified through 1986, at an estimated program cost of approximately $1.2 billion.

B-52G Air Launched Cruise
Missile Integration

Class V Modification Number 3022 will modify the external wing pylons and internal rotary launcher on the B-52G to carry a total of 20 cruise missiles (8:41). This modification will be performed in conjunction with number 3023 and will extend from 1982 through 1990. A total of 173 B-52Gs will be affected at an estimated program cost of $900 million.

Respondents' Position Titles

System Program Director

Deputy System Manager

Deputy Program Manager for Logistics

Electronic Warfare Program Manager

Chief, Program Control Division

Chief, Contracts Division

Acquisition Contracting Staff Officer (two respondents)

Procuring Contracting Officer

System Control Officer (two respondents)

Program Element Monitor

Respondents' Organizational Addresses

Directorate of Maintenance Engineering and Supply
(USAF/LEY)
Headquarters United States Air Force
Washington, D.C.

Contracts Division (ASD/SD25K)
Logistics Division (ASD/SD25L)
Program Control Division (ASD/SD25P)
EF-111A TJS Program Office (ASD/SD25)
Deputy for Systems
Aeronautical Systems Division
Air Force Systems Command
Wright-Patterson AFB OH

Aircraft and Missile Systems Division (AFLC/LOAC)
Avionics and Electronic Warfare Division (AFLC/LOWW)
Deputy Chief of Staff for Logistics Operations
and
Contract Operations Division (AFLC/PMPO)
Deputy Chief of Staff for Contracts and Manufacturing
Headquarters Air Force Logistics Command
Wright-Patterson AFB OH

Contract Negotiations Branch (OO-ALC/PMWFE)
F-4 Modification Engineering Division
Ogden Air Logistics Center
Hill AFB UT

System Management and Stretch Office (WR-ALC/MMSH)
Warner-Robins Air Logistics Center
Robins AFB GA

APPENDIX C

INTERVIEW GUIDE

SECTION I--PERSONAL DEMOGRAPHICS

1. What is your current position title?

2. What is the length of your total federal service (military and/or civilian)?

_____Years _____Months

3. How long have you been assigned to this program?

_____Years _____Months

4. Have you had prior experience in managing Class V modification aquisition programs?

_____Yes _____No

A. If your answer was "yes," which program(s)?

_____

B. If your answer was "yes," for how long?

_____Years _____Months

SECTION II--PERSONAL OPINION QUESTIONS

On a Scale of 1 to 5 with 1 representing strong disagreement and 5 representing strong agreement, indicate your preference relative to each of the following statements.

1 - Strongly Disagree
2 - Disagree
3 - Neither Disagree nor Agree
4 - Agree
5 - Strongly Agree

NOTE: Feel free to expand your answer with reasons, examples, etc. As we proceed, or at the conclusion of the interview.

5. Class V modifications to an existing weapon system provide an equally effective operational capability as a new system can provide.

6. There is a clearly defined Air Force Class V modification acquisition process.

7. Based on the categorization of the different types of modifications in Air Force Regulation (AFR) 57-4, this program is correctly identified as a Class V modification.

8. A single management organization for Class V modification acquisitions exists at the Air Staff to coordinate the functions of AFSC and AFLC.

9. Some of the problems in Class V modification acquisition management are due to the rapid growth in the use of the Class V process as an alternative to new system acquisition without an appropriate growth in Class V management techniques and procedures.

10. The type of written guidance or direction on Class V modifications currently in existence is adequate to manage this program.

11. Because this is a Class V modification acquisition, the planning, programming and/or budgeting for funding on this program imposes peculiar constraints on management.

12. Class V modification hardware development and hardware implementation are separate and distinct activities which can be managed independently.

13. One line of authority and responsibility across commands exists in Class V modification acquisitions.

14. Acquisition of Class V modifications presents unique management problems compared to those encountered on new system acquisitions.

15. An aggregation of several smaller dollar value Class V modifications into one major modification program would be advantageous.

16. There is not a full understanding of the Class V modification acquisition process at:

    A. The "working level."

    B. The Major Command (MAJCOM) level.

    C. The Air Staff level.

17. When considering Class V modification acquisitions, each of the following is very problematical:

    A. System/subsystem Integration.

    B. Management Approaches.

    C. Concurrent Hardware Development and Production.

18. There is too much Air Staff involvement in the management of this program.

19. There is not enough user command involvement in the management of this program.

20. Given the opportunity to do so in the future, I would want to manage another Class V modification acquisition.

SECTION III - PERSONAL CONTRIBUTION

Please elaborate on any one or more of the above statements or identify and describe other issues or problems that are of concern to you.

APPENDIX D

ANNOTATED BIBLIOGRAPHY

This Annotated Bibliography answers Research Question One, "What research and direction is available regarding Class V modification management?" Popular literature and articles are not included in this Appendix. Examples may be found listed in the "Selected Bibliography."

This Appendix is presented in two sections. Part 1 is a listing of many of the directives and regulations which provide guidance at the various levels and during the several phases of the modification management process. Part 2 provides those studies and research projects which (1) are referred to frequently by managers or other studies, (2) are recent and timely, or (3) contribute to the study of this topic with methodology or background information.

PART 1

FORMAL GUIDANCE

OMB Circular A-109 — MAJOR SYSTEM ACQUISITIONS
5 April 1976

This Circular establishes policies, to be followed by executive branch agencies, in the management of major systems acquisition. It is intended to effect reforms that will reduce overruns and diminish the controversy regarding new system requirements. The Circular specifies key decisions, outlines the logical sequence of activities, and requires cooperative guidance by each agency head. DOD implements OMBC A-109 with DOD Directives 5000.1 and 5000.2, which are implemented in USAF by AFR 800-2.

DOD Directive 5000.1 — MAJOR SYSTEM ACQUISITIONS
18 January 1977

This Directive implements OMBC A-109 and updates DOD policy for the management of major system acquisitions. The provisions apply to the Office of the Secretary of Defense, the Joint Chiefs of Staff, and to the Military Departments and Defense Agencies. It designates system programs involving an anticipated cost of $75 million in research, development, test, and evaluation (RDT&E) or $300 million in production for consideration as major systems acquisitions.

DOD Directive 5000.2 — MAJOR SYSTEM ACQUISITION PROCESS
18 January 1977

This Directive supplements DODD 5000.1 with policies and procedures essential to DOD activities in support of the Secretary of Defense decision-making process for major systems acquisition. The acquisition process is structured to require the system programs to progress through established decision points and phases to completion or termination. The procedures, milestones, and prescribed formal review procedures and documentation set forth in this Directive support the decision-making requirement.

DOD Directive 7200.4 — FULL FUNDING OF DOD PROCUREMENT PROGRAMS
30 October 1969

This Directive is to provide for the implementation of the full funding concept with regard to the procurement programs of the Department of Defense. Full funding is the term used to describe the principle which has ben applied by the Congress in providing funds for the DOD programs which are covered within the Procurement title of the yearly appropriations act. The objective is to provide funds at the outset for the total estimated cost of a given item so that the Congress and the public can clearly see and have a complete knowledge of the full dimensions and cost when it is first presented for an appropriation.

AF Regulation 27-8 — SYSTEMS AND EQUIPMENT MODERNIZATION/ MAINTENANCE PROGRAM
6 May 1966

This Regulation establishes policies and assigns responsibilities for developing and continuously reviewing the total modernization, modification, and related depot-level maintenance effort for system and equipment initially financed from appropriations 3010, 3020, and 3080. It tells how modernization and maintenance programs are prepared, submitted, and approved. Since it is dated prior to significant new guidance, other direction may be more appropriate or current.

AF Regulation 57-1 — STATEMENT OF OPERATIONAL NEED (SON)
14 June 1979

This Regulation states AF policy for developing, documenting, and processing SON and system operational concepts. These policies apply from the identification of need and deficiencies through the entire acquisition cycle. Validated SONs provide the justification for the initiation and continuation of systems and equipment development, acquisition, and modification. This, plus AFR 800-2 and AFR 70-15, implement DODDs 5000.1 and 5000.2.

AF Regulation 57-4 MODIFICATION PROGRAM APPROVAL
15 December 1977
(C1) 1 September 1978

This Regulation prescribes the procedures for planning, documenting, and obtaining approval of a modification, and applies to the processing of modification requirements for all Air Force, Air Force Reserve, and Security Assistance activities for which the AF has logistic support responsibility. It implements those configuration control portions of AFR 65-3 that pertain to modifications and prescribes the AF forms for Class V modifications.

AF Regulation 65-3 CONFIGURATION MANAGEMENT
1 July 1974 (Joint DOD Services/Agency Regulation)

This Regulation prescribes uniform policies and guidance for the Military Services and Defense Agencies responsible for implementation of configuration management within DOD. Configuration management identifies, controls, accounts for, and audits the functional and physical characteristics of systems, equipments, and other designated material items developed, produced, operated, and supported by DOD components. It shall be applied to major defense systems and others as designated.

AF Regulation 66-14 EQUIPMENT MAINTENANCE POLICIES,
15 November 1978 OBJECTIVES, AND RESPONSIBILITIES

This Regulation outlines the policies and procedures for managing the AF equipment maintenance program and sets up the policies to be used in developing maintenance concepts. This regulation applies to all AF activities, systems and equipment except civil engineering, medical, vehicular, and automated data processing equipment and components (managed under AF 300-series directives). It implements, among others, DODDs 5000.1 and 5000.2. The main goal of the Equipment Maintenance Program is to keep systems and equipment ready to perform their missions at the least cost to the government.

AF Regulation 70-15
16 April 1976

SOURCE SELECTION POLICY AND PROCEDURES

This Regulation establishes policy, assigns authority and responsibilities, and prescribes implementing procedures for soliciting and evaluating offerors' proposals and for selecting sources for development and production of major defense systems, subsystems, and components as well as other major programs or projects competitively procured by the Department of the Air Force. It is consistent with current systems acquisition/program management policies in AFR 800-2.

AF Manual 172-1
15 March 1974
(C3) 11 May 1977

USAF BUDGET MANUAL POLICIES AND PROCEDURES

This Manual is a compilation of instructions, procedures, and forms pertaining to performance of budget functions. It defines financial management as the process of determining requirements, obtaining resources, and judiciously applying assets to accomplish predetermined objectives within available resources. The objective of financial management is effective and efficient use of resources to meet both the direct mission and support responsibilities of the USAF.

AF Pamphlet 172-4
March 1978

THE AIR FORCE BUDGET

This pamphlet is designed by the Comptroller of the Air Force to describe the Federal, DOD, and USAF budget systems. Significant changes in the Air Force budgetary policy are included. Improvements in the effectiveness of the planning, programming, and budgeting system (PPBS) as the fundamental decision tool for the creating of the Air Force program and budget and the further evolution of zero base budgeting (ZBB) are discussed. A brief overview of the FY 79 Air Force Budget as presented by the President to Congress is provided for added insight.

AF Regulation 172-14
6 July 1978

FULL FUNDING OF AIR FORCE PROCUREMENT PROGRAMS

This Regulation prescribes the full funding concept for the Air Force procurement programs. It applies exclusively to AF procurement appropriations and to the budget and procurement activities of Headquarters USAF, AFLC, AFSC, and the USAF Security Service. It implements DODD 7200.4, which explains the full funding concept.

AF Regulation 800-2
14 November 1977

ACQUISITION PROGRAM MANAGEMENT

This Regulation states the policy for managing all AF acquisition and modification programs that are funded either through procurement appropriations, through the security assistance programs, or through the Reseach, Development, Test, and Evaluation (RDT&E) appropriation. It implements DODDs 5000.1 and 5000.2. It requires that "all persons involved in acquisition programs must comply with this regulation," provides general delegation of management responsibilities, and explains DOD and USAF terminology.

AFLC Supplement 1, 14 July 1978, provides for AFALD responsibility for procedural matters related to acquisition management and documentation of procedural guidance; Headquarters USAF will provide policy guidance.

AF Regulation 800-4
10 March 1975

TRANSFER OF PROGRAM MANAGEMENT RESPONSIBILITY

This Regulation provides for the transfer from an implementing to a supporting command. For systems and equipment it provides specific AFSC/AFLC PMRT guidance and Coordinated PMRT Plan. For Class IV and V modifications, and other programs where AFLC is initially designated as the implementing command and AFSC has engineering or other responsibility, a limited PMRT agreement is required.

AF Regulation 800-21 INTERIM CONTRACTOR SUPPORT FOR
26 September 1978 SYSTEMS AND EQUIPMENT

This Regulation provides for ICS as "a cost-effective logistics support alternative for a major system or high cost or risk Class V modificaton." High cost or risk is defined as: unit cost of $500,000 or more, nonrecurring cost of $5 million or more, or total cost of $25 million or more. It allows the AF to defer investment in all or part of the support resources (such as spares, technical data, support equipment, and training equipment) and to use contractor support while the organic capability is being phased in.

AFLC Regulation 27-1 MODIFICATION PROGRAM DATA
23 January 1976

This Regulation establishes policies and procedures for the SM and the "Group B" IM relative to Group B equipment and support equipment data required for approved and tentative Class V and Class IV modifications. Terminology and forms are explained.

AFLC/AFSC Regulation 57-3 CLASS V MODIFICATION MANAGEMENT
30 December 1970

This Regulation prescribes standard policies and procedures and assigns responsibilities by which AFSC and AFLC activities prepare Class V modification proposal analysis (MPA) and other documentation prescribed by AFR 57-4, and implement Class V modification proposal directives (MPD) issued in accordance with AFR 66-43, during acquisition and post-acquisition of systems/equipment. In addition, it prescribes the AFSC and AFLC interfaces required in both areas. The publication date indicates other guidance on the same subject is more current.

AFLC Regulation 57-21 MODIFICATION PROGRAM APPROVAL
12 April 1979

This Regulation sets forth policies and procedures for the documentation, processing, and approval of AF modification programs following transfer of PMR from AFSC to AFLC. It implements AFR 57-4; and applies to all ALCs, AFALD, and AGMC. It outlines AFLC responsibilities in support of AFSC-managed updating changes and Class V modifications before PMRT. Chapter 5, "Processing of Class V Modifications," details policy and responsibilities for the SM/IM ALC, the SM/IM, Resources Management Division, Review Panel, and Engineering Divisions.

AFLC Regulation 66-21 SYSTEMS AND EQUIPMENT MODIFICATION/
30 May 1979 MAINTENANCE PROGRAM (G079)

This Regulation provides policies and procedures for use and management of the Automated Data System Designator (DSD) G079, Systems and Equipment Modification/ Maintenance Program (SEMMP), the Approved Modification/ Maintenance Program (AMMP), and the Modification Program Progress Report (MPPR). AFR 27-8 requires data be provided to Headquarters USAF, Headquarters AFLC, and ALCs, and other MAJCOMs on modification and maintenance requirements, program funds status, and schedules of all major AF weapon systems and equipment. These programs collect, maintain, and report this data.

AFLC Manual 800-1 PROGRAM MANAGEMENT
29 December 1972

This Manual implements the 800-series AF regulations and related directives for system, subsystem, and equipment programs. The purpose of the manual is to assemble and reference in one document all significant guidance for the execution of program management responsibilities assigned to AFLC. Part one--"Acquisition Management Concept"--is a reiteration of the Acquisition Life Cycle; Part Two--"Logistics/Acquisition Interface Management"--is to be superseded by AFLC/AFSC Pamphlet 800-34.

AFSC Pamphlet 800-3 A GUIDE FOR PROGRAM MANAGEMENT
9 April 1976

This Pamphlet describes the general considerations involved in managing the acquisition of a system. The first chapters illustrate the general sequence of events in the system life cycle, with the succeeding chapters addressing principle functional processes which may be accomplished during acquisition. Modification and modification process are not addressed, even as alternatives.

AFLC/AFSC Pamphlet 800-34 (draft) ACQUISITION LOGISTICS MANAGEMENT

This Pamphlet is to serve as the basic reference document for acquisition logistics matters with AFLC and AFSC. It is intended to provide guidance and information which will aid the Integrated Logistics Support Office (ILSO) and other organizations within the Program Office and AFLC/AFSC field activities in understanding their roles, functions, responsibilities, and interfaces. Each chapter addresses a specific functional area or process--Chapter 26 addresses "Class V Modifications," providing models and a desciption of the process.

PART 2

STUDIES AND RESEARCH PROJECTS

The Procurement Process and Program Cost Outcomes
June 1971 Richard Stephen Sapp

This study uses a systems approach to view the process by which the DOD acquires and modifies its major weapon systems. Attention is focused on program cost outcomes and categorizes efforts to explain or predict cost outcomes. A model of the procurement process is developed by systems diagramming; the model demonstrates the multiplicity of relationships affecting defense programs. Case histories of two large aircraft modifications are reviewed and used to gain insight into the modification process, determine data availability, and see if causes of the cost outcome could be determined. The study concludes from these two programs--the C-130 Center Wing Class IV Modification and the B-52 Stability Augmentation System Class IV Modification--that these large modification programs exhibit the basic characteristics of major weapon system acquisition programs, and that the procurement process model developed by the researcher is applicable to such modification programs.

Evaluation of Management Responsibilities in the Air Force Aircraft Modification Program
August 1973 Donald E. Haslam & Calvin C. Berger

This study was intended to determine if misunderstandings of assigned responsibilities exist in the management of the USAF Aircraft Modification Program, and directs its research at (1) the identification of modification management responsibilities, (2) whether misunderstandings exist in the implementation of these responsibilities, and (3) corrective action which can be taken to reduce the possibility of misunderstandings. Using AF and MAJCOM publications, good descriptions and wire diagrams of the responsibilities and interrelationships between commands are developed. Using structured interviews with "personnel filling key modification management positions" in the F/FB-111 weapon system, the study concludes that misunderstandings do exist and identifies eight problem areas and recommends solutions. These emphasize the need for improved guidance and OJT, and call for working committees/review sessions to maintain currency and resolve non-routine problems.

The Program Manager in Air Force Logistics Command, Is He Needed?

May 1974 Herbert G. Bryant

This project report provides a comprehensive description of the requirement and approval procedures for USAF modification/modernization programs (based predominately on AFR 57-1 and AFR 57-4). The author describes the size and scope of the program, and desribes how, overall, the direction is clear and management is good. The problems described are broad in nature, beginning with the new system vs. modification of existing system decision, through data and budgeting decision, to deciding the quantity of spares required during a modernization period. He recommends more formal approval of programs over $5 million and better training for systems managers to preclude or minimize typical program problems.

The Process for Identifying Needs and Establishing Requirements for Major Weapon Systems in the Department of Defense

October 1974 United States Government Accounting Office

The objective of this survey was to identify the formal process within DOD that leads to the acquisition of a specific system with stated operational capabilities, and thereby place GAO in a better position to examine weapon system requirements. The report notes that no matter how much maintenance or modification the services accomplish, new major system acquisition is necessary, and provides a good primer on that subject (allowing for some changes in terminology, etc.). The requirement/approval/planning/budgeting procedure is explained in detail, and the roles of key positions and the services are described.

Class V Modification Management and Planning:
A Guide for the AFSC Program Manager of
Less-Than-Major Systems

May 1977 Reginald M. Cilvik

The study project is addressed to the AFSC program manager (of a less-than-major system) faced with acquisition, production, and installation of new equipment via a Class V modification under AFLC management. The application is much broader, however, since the following are accomplished in some detail: (1) a summary of the basic applicable DOD/USAF policy documentation and AFLC policy and organization; (2) an explanation of the Planning, Programming and Budgeting System (PPBS) and the preparation and timing of the Class V modification budget; (3) perceptions of and problems with the Class V modification process, derived from interviews with Headquarters USAF, AFLC, and AFSC personnel; and (4) some guidelines for the AFSC PM to aid in understanding and accomplishing his program.

A Faster Response to Threat Changes
and User Requirements

April 1978 Robert P. Lavoie

This research paper reviews three major, high level, top-down assessments of the R&D process (1956 to 1977) to set the background for a "bottom up" look at the lengthy, reactive process that responds to threat changes or new mission requirements long after they are confirmed. The view of the complex management environment suggests that the existing policies and procedures may not be the driving factors in this process, specifically with respect to the modification/modernization programs. Organizational and administrative changes and the adoption of a fundamental investment strategy are proposed; the new decision process would include consideration of minor and major modification activity during the system's life.

F-4E Advanced Avionics Integration Program: Lessons Learned

May 1978 — Larry Bagley

This research study report describes the program initiated to avoid interface problems in the integration of numerous advanced avionics subsystems into the F-4E. The report claims this program improved coordination between the independent subsystem Program Offices, identified interface and hardware deficiencies and improved overall and individual system capabilities. The lessons learned from the F-4E Advanced Avionics Integration Program were considered typical of an integration management situation; this case study provides examples of the system/subsystem integration, management, funding, and hardware development/implementation concurrency problems described in other studies (and the bases of this research project's interviews).

Class V Modifications: Problems in Improving Existing Weapon Systems and Equipment

May 1978 — Frankie A. Kubecka

This research study develops what the author considers "a typical sequence of events that describes the Class V modification process." The study provides specific problems and recommendations, which are combined into the three generic problem areas of: concurrent hardware development and production, management approaches, and system/subsystem integration. The work is very similar to the Report of AFALD/AQI Project 77-6, "Air Force Management of Class V Modifications," 10 June 1977. The findings have been reviewed and are now available as AFALD/AQI Project Report, "Acquisition of Class V Modifications," (Projects 77-23 through 77-27) 16 February 1979.

Acquisition of Class V Modifications (Project 77-23 through 77-27)

16 February 1979 — Terry L. Balven

This paper is the final report of five AFLC's Air Force Acquisition Logistics Division, Directorate of Logistics Integration (AFALD/AQI) Projects established as elements of an overall effort intended to improve the acquisition of new capabilities as Class V modifications. The five projects are: Class V Modification Planning Guidance, System Management Responsibilities in Class V Modifications, Integration of Concurrent Class V Modifications, Planning and Scheduling of Modifications, and Approval and Direction of Class V Modifications. The projects deal with eleven issues which were "raised so frequently" in an earlier project which sought out deficiencies or problems in the acquisition of modifications. Included in the report is a discussion, conclusion, and recommendation for each of the issues, as well as an overall conclusion and proposed solution for greater involvement of the system manager in the development phase of planning for the fulfillment of an Air Force requirement.

Modification Management

As of June 1979 — HQ AFLC, DCS Logistics Operations, Directorate for Aerospace Systems HQ AFLC/LOA

This briefing is used by Headquarters AFLC staff personnel as guest lecturers for AF Institute of Technology, School of Systems and Logistics' Continuing Education courses. The briefing covers the various classes of modifications, basic policies and procedures under which the program operates, the organization and operation of the Configuration Control Board at both Headquarters AFLC and the Air Logistics Centers, and some examples of the magnitude of the modification program. The chain-of-events models for each Class IV and Class V Modification processing, presented from the AFLC viewpoint, are simple but descriptive.

A Guide for the AFLC Program Manager of Major Production Class IV and V Modifications

September 1979 — Richard S. MacIsaac

Recognizing that much of the guidance for modification managers is out-of-date or inconsistent between the two major commands (AFLC and AFSC) involved, MacIsaac has sought to provide a handbook for the Deputy Program Manager for Logistics (DPML), who fills an important and responsible position in the MAJCOM interface. The thesis (1) describes the major modification management process, (2) identifies relevant formal guidance, (3) discusses "lessons learned" contributed by modification managers, and (4) describes alternative management approaches for major Class IV and Class V modification programs.

SELECTED BIBLIOGRAPHY

A. REFERENCES CITED

1. Air Force Logistics Command. "Modification Management." Official briefing, HQ AFLC/LOA, Wright-Patterson AFB OH, 1979.

2. Bagley, Major Larry, USAF. "F-4E Advanced Avionics Integration Program: Lessons Learned." Unpublished research study report, unnumbered, Air Command and Staff College, Maxwell AFB AL, May 1978.

3. Balven, Captain Terry L., USAF. "Acquisition of Class V Modifications," AQI Project Report, Projects 77-23 through 77-27. AFALD/AQI, Wright-Patterson AFB OH, 16 February 1979.

4. Bush, Captain Don G., USAF. "An Analysis of Modification Development through Material Improvement Projects." Unpublished master's thesis, SLSR 71-71B, AFIT/SL, Wright-Patterson AFB OH, August 1971.

5. Cilvik, Lieutenant Colonel Reginald M., USAF. "Class V Modification Management and Planning: A Guide for the AFSC Program Manager of Less-Than-Major Systems." Unpublished study project report, unnumbered, Defense Systems Management College, Fort Belvoir VA, May 1977.

6. Coleman, Herbert J. "Defense Studying Future Needs," Aviation Week and Space Technology, March 13, 1978, pp. 23-25.

7. Haslam, Captain Donald E., USAF, and Calvin C. Berger. "Evaluation of Management Responsibilities in the Air Force Aircraft Modification Program." Unpublished master's thesis, SLSR 6-73B, AFIT/SL, Wright-Patterson AFB OH, August 1973.

8. Holder, William G. "The Ever-Changing Fleet," Air University Review, July-August, 1978, pp. 31-42.

9. Lavoie, Colonel Robert P., USAF. "A Faster Response to Threat Changes and User Requirements." Unpublished research paper, Report No. 392, Air War College, Maxwell AFB AL, April 1978.

10. MacIsaac, Captain Richard S., USAF. "A Guide for the AFLC Program Manager of Major Production Class IV & V Modifications." Unpublished master's thesis, LSSR 30-79B, AFIT/SL, Wright-Patterson AFB OH, August 1979.

11. Office of Federal Procurement Policy. Major System Acquisitions: A Discussion of the Application of OMB Circular No. A-109. OFPP Pamphlet No. 1. Washington: Government Printing Office, August 1976.

12. Office of Management and Budget. Report to the Congress, 1976, Office of Federal Procurement Policy. Washington: Government Printing Office, May 1977.

13. Sapp, Major Richard S., USAF. "The Procurement Process and Program Cost Outcomes: A Systems Approach." Unpublished doctoral dissertation, Industrial Engineering Department, Purdue University, West Lafayette IN, June 1971.

14. U.S. Department of Defense. Report of Secretary of Defense Harold Brown to the Congress of the FY 1980 Budget, FY 1981 Authorization Request and FY 1980-1984 Defense Programs. Washington: Government Printing Office, 25 January 1979.

15. U.S. Department of the Air Force. Acquisition Program Management. AFR 800-2. Washington: Government Printing Office, 14 November 1977.

16. _____. Air Force Acquisition Logistics Division. Acquisition Logistics Management. AFLC/AFSCP 800-34. Wright-Patterson AFB OH, Proposed.

17. _____. "Department of the Air Force Submission for Aircraft Modifications to the President's Budget." P3X Report, HQ USAF/LEX, Washington DC, as of 1 February 1979.

18. _____. Engineering for Defense Systems. AFR 800-3. Washington: Government Printing Office, 17 June 1977.

19. _____. Modification Program Approval, AFR 57-4 (CI). Washington: Government Printing Office, 1 September 1978.

20. U.S. General Accounting Office. The Process of Identifying Needs and Establishing Requirements for Major Weapon Systems in the Department of Defense. Report No. B-163058. Washington: Government Printing Office, 23 October 1974.

B. RELATED SOURCES

Balven, Terry L., Captain, USAF. "Air Force Management of Class V Modifications." AQI Project Report 77-6. AFALD/AQI, Wright-Patterson AFB OH, 10 June 1977.

Bryant, Herbert G. "The Program Manager in Air Force Logistics Command, Is He Needed?" Unpublished study project report, unnumbered, Defense Systems Management College, Fort Belvoir VA, May 1974.

Coulam, Robert F. Illusions of Choice: The F-111 and the Problem of Weapons Acquisition Reform. Princeton NJ: Princeton University Press, 1977.

Emory, C. William. Business Research Methods. Homewood IL: Richard D. Irwin, Inc., 1976.

Gambill, Major Jack H., USAF, and Captain Ken Sinclair, USAF. "Logistics Management by Weapon System." XRS Report 76-11, HQ AFLC/XRS, Wright-Patterson AFB OH, April 1977.

Kubecka, Captain Frankie A., USAF. "Class V Modifications: Problems in Improving Existing Weapon Systems and Equipment." Unpublished research study, report No. 1365-78, Air Command and Staff College, Maxwell AFB AL, May 1978.

Office of Management and Budget. Major System Acquisition. OMB Circular A-109. Washington: Government Printing Office, 5 April 1976.

Rice, Berkeley. The C-5A Scandal. Boston: Houghton-Mifflin Company, 1971.

U.S. Department of Defense. Configuration Management. DOD Directive 5010.19. Washington: Government Printing Office, 17 July 1968.

_____. Full Funding of DOD Procurement Programs. DOD Directive 7200.4. Washington: Government Printing Office, 30 October 1969.

_____. Major System Acquisition. DOD Directive 5000.1. Washington: Government Printing Office, 18 January 1977.

_____. Major System Acquisition Process. DOD Directive 5000.2. Washington: Government Printing Office, 18 January 1977.

U.S. Department of the Air Force. Air Force Logistics Command and Air Force Systems Command. Class V Modification Management. AFLC/AFSCR 57-3. Wright-Patterson AFB OH, 30 December 1970.

_____. Air Force Logistics Command. Modification Program Approval. AFLCR 57-21. Wright-Patterson AFB OH, 12 April 1979.

_____. Air Force Logistics Command. Modification Program Data. AFLCR 27-1. Wright-Patterson AFB OH, 23 January 1976.

_____. Air Force Logistics Command. Program Management. AFLCM 800-1. Wright-Patterson AFB OH, 29 December 1972.

_____. Air Force Logistics Command. Systems and Equipment Modification/ Maintenance Program (G079). AFLCR 66-1. Wright-Patterson AFB OH, 30 May 1979.

_____. Air Force Systems Command. A Guide for Program Management. AFSCP 800-3. Andrews AFB MD, 9 April 1976.

_____. Configuration Management. AFR 65-3. Washington: Government Printing Office, 1 July 1974.

_____. Equipment Maintenance Policies, Objectives, and Responsibilities. AFR 66-14. Washington: Government Printing Office, 15 November 1978.

_____. Foreign Military Sales. AFR 400-3. Washington: Government Printing Office, 18 May 1978.

_____. Full Funding of Air Force Procurement Programs. AFR 172-14. Washington: Government Printing Office, 6 July 1978.

_____. Interim Contractor Support for Systems and Equipment. AFR 800-21. Washington: Government Printing Office, 26 September 1978.

_____. Source Selection Policy and Procedures. AFR 70-15. Washington: Government Printing Office, 16 April 1976.

_____. Statement of Operational Need (SON). AFR 57-1. Washington: Government Printing Office, 14 June 1979.

_____. Systems and Equipment Modernization/Maintenance Program. AFR 27-8. Washington: Government Printing Office, 6 May 1966.

_____. The Air Force Budget. AFP 172-4. Washington: Government Printing Office, March 1978.

_____. Transfer of Program Management Responsibility. AFR 800-4. Washington: Government Printing Office, 10 March 1975.

_____. USAF Budget Manual Policies and Procedures. AFM 172-1(C3). Washington: Government Printing Office, 11 May 1977.